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September 22, 2008

Via Federal Express

Public Comments Processing
Attn: FWS-R2-ES-2008-0070
Division of Policy and Directives Management
U.S. Fish and Wildlife Service
4401 North Fairfax Drive
Suite 222
Arlington, Virginia 22203

Re: 90-Day Finding on a Petition to List *Glaucidium ridgwayi* [sic] cactorum as Threatened or Endangered with Critical Habitat

Dear sir or madam:

We are the attorneys for the Southern Arizona Home Builders Association ("SAHBA"), and have been authorized to act on its behalf in connection with this matter. Pursuant to SAHBA's request, we are providing comments (including certain scientific reports) concerning the U.S. Fish and Wildlife Service's ("FWS") 90-Day Finding on a Petition to List the Cactus Ferruginous Pygmy-Owl (Glaucidium ridgwayi cactorum) as Threatened or Endangered with Critical Habitat, 73 Fed. Reg. 31,418 (June 2, 2008) ("90-Day Finding"). In the 90-Day Finding, FWS initiated a 12-month status review and requested input regarding the distribution, genetics and taxonomy of ferruginous pygmy-owls. The purpose of this letter is to respond to the agency's request for information, and to ensure that the best scientific and commercial information is used in determining whether to list this "new" species of owl.

Included with this letter are the following scientific reports:

1. R. Roy Johnson and Steven W. Carothers, A Scientific Analysis of the March 15, 2007 Petition and the June 2, 2008, 90-Day Finding on a Petition to List the Cactus Ferruginous Pygmy-Owl as a Threatened or Endangered Species (August 2008) ("Johnson and Carothers 2008"), attached at Tab A. This scientific report focuses on the genetics and taxonomy of ferruginous pygmy-owls and concludes there is no scientific basis for FWS to accept a new pygmy-owl species, namely, Glaucidium ridgwayi.

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- 2. R. Roy Johnson and Steven W. Carothers, A Scientific Analysis of the March 15, 2007, Petition to List the Cactus Ferruginous Pygmy-Owl as a Threatened or Endangered Species (May 2007) ("Johnson and Carothers 2007"), attached at Tab B. This report provides a scientific analysis of the Petition filed on March 15, 2007, and identifies a number of errors and unsupported assertions in that document, which FWS accepted as "reliable" without any critical evaluation, in many cases based on undisclosed "information in our files."
- 3. WestLand Resources, Inc. ("WestLand"), Comments on the 90-Day Finding on a Petition to List the Cactus Ferruginous Pygmy-Owl (Glaucidium Ridgewayi Cactorum) as Threatened or Endangered with Critical Habitat (September 2008) ("WestLand Report"), attached at Tab C. This document provides information concerning the current range, distribution and threats to pygmy-owls in Arizona and northern Sonora, explaining that virtually all of the land within the pygmy-owl's range in southern Arizona is owned and controlled either by the federal or state government or by the Tohono O'odham Tribe, and faces little threat of development or intensive use.
- 4. R. Roy Johnson and Steven W. Carothers, *Distributional History and Current Status of the Cactus Ferruginous Pygmy-Owl (Glaucidium brasilianum cactorum) in Arizona* (September 2005) ("*Distributional History*"), attached at Tab D. This report discusses the historic distribution of pygmy-owls in Arizona based on published documents and museum specimens since the species' discovery over 100 years ago, and addresses a number of misconceptions about the pygmy-owl, some of which are repeated by FWS in its 90-Day Finding. The authors show that the pygmy-owl has always been rare in Arizona, like some 70 other avian species from the tropics and subtropics whose range barely extends into the southwestern United States.
- 5. R. Roy Johnson and Steven W. Carothers, U.S. Fish and Wildlife Service White Paper: Significance of the Western Populations of the Cactus Ferruginous Pygmy-Owl, A Review and Rebuttal (June 2005) ("Review and Rebuttal"), attached at Tab E. This report addresses the assertion found in an internal (but publicly circulated) "white paper" prepared by employees in FWS's Tucson field office to justify the listing the Arizona pygmy-owl population following the Ninth Circuit's determination that the listing was arbitrary and capricious. National Ass'n of Home Builders v. Norton, 340 F.3d 835 (9th Cir. 2003). The report identifies a number of errors and misconceptions in the "white paper," including the lack of any scientific basis for treating pygmy-owls in southern Arizona and northern Sonora as a distinct population segment.

¹ This report is also attached as Attachment A to Johnson and Carothers 2008. For your convenience, we are separately attaching the report, which was previously submitted to FWS, but not addressed in the 90-Day Finding.

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We ask that, in addition to this letter, these reports be included in the administrative record and be considered in connection with the agency's status review and 12-month finding, together with the other reports, papers, and scientific information cited by Johnson and Carothers and by WestLand Resources.

The balance of this letter will discuss the legal framework and criteria for the listing of a species. We will also highlight several problematic aspects of the Petition, the species' historical and current status and distribution, and the Petition's and 90-Day Finding's confusion of the taxonomy of ferruginous pygmy-owls.

1. The Legal Framework for Listing Species

Section 4 of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533, establishes the criteria and procedures for listing species, as well as the designation of species' critical habitat. Congress has described Section 4 as "the cornerstone of effective implementation" of the ESA "because it sets in motion the Act's other provisions, including the protective regulations, consultation requirements and recovery efforts." S. Rep. No. 97-418, at 16 (1982). A species may be listed as "endangered" if it is "in danger of extinction throughout all or a significant portion of its range," 16 U.S.C. § 1532(6), or as "threatened" if it is "likely to become endangered," *id.* at § 1532(20).

The listing process may be initiated by either FWS, through the identification of candidate species believed to qualify for listing, or by any "interested person," who files a written petition that contains substantial evidence supporting the proposed listing. See 50 C.F.R. § 424.14. FWS must make a finding on whether a petitioned action may be warranted within 90 days after the petition is filed "to the maximum extent practicable." 16 U.S.C. § 1533(b)(3)(A); 50 C.F.R. § 424.14(b)(1). If FWS finds that listing may be warranted, it must initiate a status review and, within 12 months, make a formal finding on whether listing is warranted.

The ESA prescribes five specific factors that must be considered in connection with listing or delisting a species. Those factors are:

- (1) The present or threatened destruction, modification or curtailment of the species' habitat or range:
- (2) Overuse for commercial, recreational, scientific or educational purposes;
- (3) Disease or predation;
- (4) The inadequacy of existing regulatory mechanisms to protect the species; or

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(5) Other natural or man-made factors concerning or affecting the species' continued existence.

Id. at § 1533(a)(1). These factors must be analyzed based solely on "the best scientific and commercial data available, after taking into account any efforts being made by a foreign country, state or political subdivision to protect the species. Id. at § 1533(b)(1)(A). As explained by Congress, the "addition of the word solely [was] intended to remove from the process of listing or delisting of species any factor not related to the biological status of the species." H. Rep. No. 97-567, at 20 (1982), reprinted in 1982 U.S.C.C.A.N. 2820. The Supreme Court similarly explained that the "obvious purpose" of this requirement "is to ensure that the ESA not be implemented haphazardly, on the basis of speculation or surmise." Bennett v. Spear, 520 U.S. 154, 176 (1997).

The regulations adopted jointly by FWS and the National Marine Fisheries Service implementing Section 4 also provide:

In determining whether a particular taxon or population is a species for purposes of the Act, the Secretary *shall rely on standard taxonomic distinctions* and the biological expertise of the Department and the scientific community concerning the relevant taxonomic group.

50 C.F.R. § 424.11(a) (emphasis supplied). The preamble to this rule emphasized, in response to comments regarding the quality of the biological data used in the listing process, "that listing decisions should not be made on the basis of faulty or inconclusive information." *Listing Endangered and Threatened Species and Designating Critical Habitat; Final Rule*, 49 Fed. Reg. 38,900, 38,903 (Oct. 1, 1984) ("1984 Preamble"). *See also Notice of Interagency Cooperative Policy on Information Standards Under the Endangered Species Act*, 59 Fed. Reg. 34,271 (July 1, 1994) ("Information Standards Policy").

2. The Petition to List the Cactus Ferruginous Pygmy-Owl

In 2006, FWS published a final rule to remove the Arizona population of the cactus ferruginous pygmy-owl from the endangered species list. Final Rule to Remove the Arizona Distinct Population Segment of the Cactus Ferruginous Pygmy-owl (Glaucidium brasilianum cactorum) from the Federal List of Endangered and Threatened Wildlife, 71 Fed. Reg. 19,452 (Apr. 14, 2006) ("Delisting Rule"). The Delisting Rule was the culmination of nearly seven years of litigation concerning whether the Arizona pygmy-owl population was eligible for listing as a distinct population segment. See, e.g., National Ass'n of Home Builders, supra. In the Delisting Rule, and following the decision of the Ninth Circuit, FWS concluded that the Arizona

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pygmy-owl population is not a listable entity. Applying the DPS Policy,² FWS found the Arizona population represents only a small percentage of the species' total range and therefore is not significant to the taxon as a whole. Delisting Rule, 71 Fed. Reg. at 19,458.

The status of the species has not changed since the Delisting Rule. But the Petitioners seek to side-step the conclusions in the Delisting Rule by suggesting that the Arizona pygmy-owl population is now comprised of a *different species*. For over 100 years, the Arizona pygmy-owls have been classified as a member of the species *Glaucidium brasilianum* (i.e., the ferruginous pygmy-owl), the range of which extends from southern Arizona and Texas south through Mexico and Central America into South America. *See* Cartron, *et al.*, *Ecology and Conservation of the Cactus Ferruginous Pygmy-Owl in Arizona* (USDA Forest Service, Rocky Mountain Research Station 2000) at 5; Johnson and Carothers 2007 at 15-16; Johnson and Carothers, *Distributional History* at 13. The ferruginous pygmy-owl is considered common or abundant throughout most of its range, and has been described as the species most often collected in Mexico. Cartron, *et al.*, *supra*, at 5.

Without following the standard protocol for changes in avian taxonomy and nomenclature, Petitioners now suggest a radical realignment of the species' taxonomy, under which Arizona pygmy-owls would be declared members of an entirely new species, *Glaucidium ridgwayi*, whose range includes most of Mexico as well as southern Arizona and Texas. Petition at 1. The obvious purpose of discarding the accepted taxonomy of *Glaucidium brasilianum* is to reduce the range of the species/subspecies to which the Pygmy-Owl³ belongs, increasing the chances of listing a species unit that includes the Petitioners' desired population. In the end, the Petition is a classic instance of "biased analyses" with "shaky scientific foundations" upon which "listing decisions should not be made." 1984 Preamble, 49 Fed. Reg. at 38,903.

(a) The Accepted Taxonomy of the Pygmy-Owl

The 90-Day Finding glosses over the fact that it is considering the listing of an unrecognized species by focusing on the two proposed subspecies of the new species, *G. r. cactorum* and *G. r. ridgwayi*. 90-Day Finding, 73 Fed. Reg. at 31,421. Before jumping to the subspecies level, however, FWS must utilize "standard taxonomic distinctions" to determine

² Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act, 61 Fed. Reg. 4,722 (Feb. 7, 1996) ("DPS Policy").

³ Our use of "Pygmy-Owl" hereinafter refers to the *G. b. cactorum*, the recognized ferruginous pygmy-owl subspecies whose range extends from southern Arizona south through western Mexico to the States of Colima and Michoacan, as described in Cartron, *supra*, at 5-7. The nomenclature proposed by Petitioners and utilized by FWS is confusing and misleading. Petitioners suggest the acceptance of a new species, *Glaucidium ridgwayi*, but retain the use of the common name, cactus ferruginous pygmy-owl. This violates the protocols and official policy of the American Ornithologists' Union. Johnson and Carothers 2008 at 10-11.

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whether *G. ridgwayi* is a valid species accepted by the scientific community. 50 C.F.R. § 424.11(a). This point is critical because if the petitioned action pertains to a non-existent species, it must, by rule, be rejected. *Ibid.*

The American Ornithologists' Union ("AOU") is the accepted authority for English bird names and scientific nomenclature. According to the AOU, "the most recent official name for the Ferruginous Pygmy-Owl in North America, as well as Middle and South America, is Glaucidium brasilianum, not Glaucidium ridgwayi." Johnson and Carothers 2008 at 7. The AOU's last official checklist was published in 1998, and annual supplements since then, including 2008, do not recognize G. ridgwayi. In fact, G. ridgwayi is not recognized in any official checklist. Ibid. The most recent compilation of the scientifically accepted taxonomy for ferruginous pygmy-owls was compiled by Cartron, Richardson, and Proudfoot in 2000. See Cartron, et al., supra, at 5-7. The authors acknowledge that the (Arizona) Pygmy-Owl is of the genus Glaucidium (order Strigiformes, family Strigidae), of the species brasilianum, and of the subspecies cactorum, commonly referred to as the cactus ferruginous pygmy-owl. See also Johnson and Carothers, Distributional History at 13-14 (summarizing currently recognized taxonomy). Consequently, the petitioned action is groundless.

(b) "Glaucidium ridgwayi" Is Not Recognized as a Species

The Petitioners suggest that FWS should proclaim the existence of a new species of pygmy-owls, namely, the *Glaucidium ridgwayi*, relying on Konig 1999⁴ and Proudfoot 2006.⁵ The process for revising ornithological taxonomy and nomenclature, however, does not occur overnight and consists of a rigorous scientific process. Johnson and Carothers 2008 at 8. Proposed species that are ultimately accepted frequently run the scientific gauntlet for many years (if not decades) before formally receiving acceptance under standard taxonomic distinctions. Frequently, suggested taxonomic changes do not receive acceptance by the scientific community. *Ibid.* Notably, the first step in the process is to submit a formal proposal to the AOU. The scientists Petitioners rely on have not initiated this process.

Part of the rationale for AOU's protocol is to restrict the influence of agendas or faulty or inconclusive science on taxonomic classifications. As evidenced by the present matter, the alteration of such classifications is highly controversial and has impacts far beyond an addition to the checklist. Thus, it is vital that such changes be vetted through the scientific community before being utilized as a means to formulate legal policy. That is, the science should form the legal policy; legal policy should not be used to frame the science. This is the basis for the ESA's requirement that listing decisions be based solely on the best scientific and commercial data available.

⁴ Konig et al., Owls: A guide to owls of the world (Yale U. Press 1999) ("Konig 1999").

⁵ Proudfoot et al., Mitochondrial DNA variation and phylogeography of the ferruginous pygmy-owl (Glaucidium brasilianum) (Conservation Genetics 2006) ("Proudfoot 2006").

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The proposals of Konig and Proudfoot, at best, are inconclusive at this juncture. For example, Konig acknowledges that additional research is needed to "conclusively [] resolve this question [of] revising the whole 'brasilianum complex.'" Konig 1999 at 373. Similarly, Proudfoot's research is based on mitochondrial DNA ("mtDNA") comparisons of only a single female cytochrome. Proudfoot notes that this technology applied to such a limited sample base is not sufficient and that "other genomic regions (e.g., microsatellites) should be studied to test these conclusions." Proudfoot 2006 at 10. Proudfoot also states that "[b]y examining both maternally and biparentally inherited genetic markers," which Proudfoot did not do, "one may obtain a detailed assessment of the genetic structure of pygmy owl populations." *Ibid.* The scientists' own recognition of the preliminary nature of their work undoubtedly explains why the AOU has not received a formal proposal.

In addition, FWS recently stated that mtDNA evidence alone is not sufficient to revise standard taxonomic classifications. In its 90-day finding for the Tucson shovel-nosed snake, FWS rejected genetic evidence based on mtDNA samples and stated that an "examination of nuclear markers" was needed to "more fully elucidate our understanding of the taxonomic understanding of this subspecies." 90-Day Finding on a Petition to List the Tucson Shovel-Nosed Snake (Chionactis occipitalis klauberi) as Threatened or Endangered with Critical Habitat, 73 Fed. Reg. 43,905, 43,906 (July 29, 2008). Presumably the same standard applies in this case as well. See Information Standards Policy, 59 Fed. Reg. at 34,271 (requiring FWS to "gather and impartially evaluate biological, ecological, and other information" when considering agency actions under the ESA).

Similarly, FWS does not typically accept genetic taxonomic revisions without verification. See, e.g., Final Rule to Amend the Listing for the Preble's Meadow Jumping Mouse (Zapus hudsonius preblei) to Specify Over What Portion of its Range the Species is Threatened, 73 Fed. Reg. 39,790, 39,791 (July 10, 2008) (FWS contracted with U.S. Geological Service to verify proposed taxonomic revision due to significance of that revision on the listing decision). In Arizona, for example, FWS rejected findings concerning the taxonomy of the Pima pineapple cactus (Coryphantha scheeri var. robustispina) that were published in a peer-reviewed journal. Robert J. Schmazel, et al., Morphomteric Variation in Coryphantha robustispina (Cactacae), in Systematic Botany 553-568 (2004). Instead, in conducting a five-year status review, FWS utilized a group of "peer reviewers" to independently review Schmazel's work and concluded that the current taxonomy of this cactus should not be revised. See U.S. Fish & Wildlife Service, 5-Year Review, available at http://www.fws.gov/southwest/es/arizona/pima.htm.

⁶ We note that in the case of the listing petition for the Tucson shovel-nosed snake, the genetic evidence suggested that the Tucson shovel-nosed snake is *not* sufficiently varied to support its classification as a separate subspecies of Western shovel-nosed snake, which, if accepted, would preclude listing. We certainly hope that FWS's Arizona field office does not rely on mtDNA evidence only when it is offered in support of a listing proposal.

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Even assuming a taxonomic revision is appropriate for *G. brasilianum*, it is certainly not the role of FWS to usurp the established protocol in the ornithological community for making such revisions. The Pygmy-Owl's classification as a subspecies of *G. brasilianum* is widely accepted in the scientific community. Therefore, FWS may not ignore that classification and – based upon preliminary and inconclusive data – declare the existence of a new species that is not recognized by the AOU or any other established authority on avian taxonomy. 50 C.F.R. § 424.11(a).

3. The Western Pygmy-Owl Population Is Not Threatened or Endangered

Setting aside the significant taxonomic problems, the real debate should be whether the Pygmy-Owl should be listed. The 90-Day Finding's review and discussion of the threats to the Pygmy-Owl is deficient in several respects. First, FWS assumes the western population is declining "in abundance in the United States and Mexico." 90-Day Finding, 73 Fed. Reg. at 31,421. This conclusion ignores the best available science, which demonstrates the population has never been "abundant" in the United States and the population south of the border is stable.

Second, the agency's analysis of purported threats ignores the fact that more than 80 percent of the current range of the Pygmy-Owl in Arizona consists of land within the Tohono O'odham Nation, national monuments, and wildlife refuges – areas that are *not* at risk for the primary threats listed. In fact, the bulk of the remaining land is owned by either the federal government or the State of Arizona, or consists of private land in isolated locations that is unlikely to be developed or used for activities other than livestock grazing. FWS's status review should address these glaring omissions and, in properly analyzing the species, find the Pygmy-Owl is not threatened or endangered.

Third, the threats that are analyzed in the 90-Day Finding focus on only a limited portion of the western population (Arizona and northern Sonora). FWS has ignored the remaining two-thirds of the Pygmy-Owl's western population. The 12-month status review must consider the status of the Pygmy-Owl throughout its entire range, including areas where owls are common.

(a) The Pygmy-Owl Was Never Common in Arizona

The Petition asserts, without reference to any supporting documentation or scientific analysis, that the Pygmy-Owl was "historically common in riparian woodlands across much of southern Arizona." Petition at iv. But the science tells a different story – one of a species on the fringe of its range that, throughout time, has erratically appeared and disappeared in Arizona's ornithological records. According to Johnson and Carothers:

While a few early observers did indicate that the bird was "of common occurrence" (Breninger 1989:128), "fairly numerous" (Gilman 1909: 148), and "quite common" (Fisher 1893: 199) in specific wet riparian habitats, the actual record of collections and

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> reported observations of Arizona's avifauna, which we summarize in this paper, strongly suggest that then CFPO was in fact uncommon in the state as far back as historical records have been kept.

Johnson and Carothers 2007 at 3; see also Johnson and Carothers, Distributional History at 2-7, 13-23, App. B and C.

Statements that the Pygmy-Owl was once "common" in southern Arizona are typically made without reference to any substantive underlying science (i.e., specimen and literature records). In fact, the records clearly show that the Pygmy-Owl was never common in Arizona. From 1872, when the owl was first discovered in Arizona, to 1953, scientists collected only 39 owls and 11 sets of eggs in the entire State of Arizona. Johnson and Carothers, *Distributional History* at 4. Pygmy-Owls are diurnal (active during daylight hours), noisy, and relatively easy to detect. *Id.* at 4. Consequently, if Pygmy-Owls were common in Arizona, a much larger number would have recorded and far more specimens taken. *Id.* at 2-4. See also Johnson and Carothers 2007 at 8-12 (summarizing historical records in Arizona).

Johnson and Carothers reviewed some 200 professional and amateur ornithological papers on southern Arizona from the late 1800's and early 1900's, and were unable to locate a single Pygmy-Owl record. Johnson and Carothers, *Distributional History* at 2-3, App. B (listing all specimens and written records from 1872-1971) and C (listing all expeditions to southern Arizona prior to 1900 that failed to collect a Pygmy-Owl). No records of Pygmy-Owls exist for the entire Gila River region between 1908 and 1971. *Id.* at 10. No records of Pygmy-Owls exist for the Santa Cruz and Verde Rivers. *Id.* at 22-23. Large historic gaps exist for the Tohono O'odham Nation lands, despite extensive surveys. *Id.* at 16-17. For example, no Pygmy-Owls were reported in that area from 1894 to 1949. *Id.* at 17.

In short, the population status of Pygmy-Owls in Arizona has always been spotty and unstable. *Id.* at 10. As Johnson and Carothers have explained in their reports, the Pygmy-Owl is like some 70 other Mexican bird species whose range barely extends into the southwestern United States. *Id.* at 25-30, App. A.

The Petition also greatly overstates the Pygmy-Owl's historical range in Arizona. Petition at 6, 15. Arizona never provided vast amount of suitable habitat for the Pygmy-Owl, which is likely why Pygmy-Owls have rarely been observed in the last 100 years. Johnson and Carothers 2007 at 8; Johnson and Carothers, *Distributional History* at 23-25, 27-30 (discussing Mexican plants and animals occurring in the U.S.). As a largely tropical and subtropical species, Arizona is the northernmost location for the entire taxon, which spans south through Mexico, Central America, and to the southern tip of South America. Johnson and Carothers, *Distributional History* at 13, 27-30. It is no surprise that, in Arizona – which has neither a tropical or subtropical climate – Pygmy-Owls prefer riparian and dense xeroriparian vegetation

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(which is analogous to Sinaloan thornscrub and similar vegetation found hundreds of miles south in Mexico) along intermittent and perennial streams. Consequently, Pygmy-Owls have actually occupied, at most, 200,000 acres of land in Arizona, excluding the southern third of the Tohono O'odham Nation. Johnson and Carothers, *Review and Rebuttal* at 8-9. Again, this is a function of the type of local conditions that will support Pygmy-Owls and other Mexican species found in southern Arizona.

(b) The Population in Sonora is Stable

FWS previously thought the "pygmy-owl [was] rare or absent in northern Sonora, within 150 miles of the United States." *Determination of Endangered Status for the Cactus Ferruginous Pygmy-Owl in Arizona*, 62 Fed. Reg. 10,730 (March 10, 1997) ("Listing Rule"). But survey efforts by Flesch in 2000 to 2004 demonstrated that "pygmy-owls are locally common" in northern Sonora. WestLand Report at 4. Since then, Flesch has opined, based upon the same survey data, that the population in northern Sonora is declining. *Ibid*.

Flesch's conclusion is highly suspect for several reasons. First, his opinion is inconsistent with prior findings based on the same data. *Id.* at 4-5 (noting Flesch (2003) and Flesch (2006) rely on 2000-2001 survey results for opposite conclusions). Second, Flesch employed faulty survey methodology,⁷ including unconventional placement of call stations, improper timing and duration of surveys, and defective techniques for measuring vegetation. WestLand Report at 5-8; Johnson and Carothers at 14-15. The survey methodology from 2000 is the most problematic and likely resulted in double counting owls. WestLand Report at 6; Johnson and Carothers 2007 at 15.

Notably, it is the reported decline between Flesch's *initial* survey period, 2000 (using faulty methodology), and 2001 (using accepted methodology) that Petitioners relied on for the alleged population decline in Sonora. This is hardly reliable data under the Information Standards Policy, and should be rejected by FWS. Excluding the questionable 2000 data, the Pygmy-Owl population in northern Sonora is stable. The number of owls detected in 2001 to 2004 were 32 and 28, respectively. Survey efforts detected 34 owls in 2005 and 33 in 2006. WestLand at 7. Thus, despite modest changes in the number of detections from year-to-year, there were 32 owls detected in 2001 and 33 detected in 2006 – essentially no change. *Ibid.* These results are consistent with the expected fluctuations in population and demonstrate that Pygmy-Owls are not declining in northern Sonora.

We do not intend to be unfairly critical of Flesch. In 2000, when he performed his initial surveys, Flesch was a graduate student at the University of Arizona attempting to obtain a

⁷ The methodology used by Flesch in 2000 is so obscure that Johnson and Carothers could locate no scientific literature supporting it, despite searching over 100 different references on standardized censusing techniques. Johnson and Carothers 2007 at 14.

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master's degree, with little or no field experience, in contrast to experts such as Johnson and Carothers. Thus, it is hardly surprising that he encountered difficulties during his initial surveys. It is also possible that some sort of one-time, stochastic event occurred between Flesch's 2000 and 2001 surveys that reduced the number of owls in the areas that he has surveys. In that case, however, we would expect such event to have been noted and discussed by Flesch in his subsequent survey reports.

Of greater concern is the failure of FWS to critically and objectively examine the results of these surveys, from which it is apparent that the results from 2000 are an outlier. Instead, FWS accepted the conclusion drawn from this single data point without any discussion. FWS "judge[d] the information regarding a decline in northern Sonora ... to be substantial and reliable," citing Flesch's 2006 report. 90-Day Finding, 73 Fed. Reg. at 31,421. Like FWS's acceptance of genetic evidence based on mtDNA in this case while rejecting it in the case of the shovel-nosed snake, the uncritical acceptance of the conclusion drawn from a single year of survey data by an inexperienced surveyor raises serious question about the quality of data considered.⁸

The reality is that there is no credible scientific evidence that there has been a decline in the number of Pygmy-Owls in northern Sonora. As WestLand discusses in its report, in the spring of 2008, the Arizona Game and Fish Department and its cooperators trapped groups of Pygmy-Owls at different latitudes at 70-kilometer (44-mile) intervals from northern Sinaloa to northern Sonora. WestLand Report at 9. A total of 119 owls were captured, and many more owls responded to calls – in some instances, as many as five owls per call station. *Ibid.* Pygmy-Owls were readily found within suitable habitat throughout the entire project area in Mexico, indicating that the Pygmy-Owls are still widespread within Sonora. *Ibid.* And, as previously stated, there is no scientific evidence that Pygmy-Owls have declined in any other portion of its range, including Arizona (where owls have always been uncommon). Consequently, the assertion that Pygmy-Owls are declining in Sonora is simply not supported by the data.

(c) There Are No Significant Threats to Suitable Pygmy-Owl Habitat

Petitioners declare the peril of the Pygmy-Owl based primarily on the threatened destruction, modification, or curtailment of its habitat. Petition at 18-24. The alleged threats in Arizona include a variety of land uses, including destruction of riparian forest, urban sprawl, groundwater pumping, water diversions, and livestock grazing. *Ibid.* In considering these

⁸ Another telling difference between the 90-day findings for the shovel-nosed snake and the Pygmy-Owl is that in the former, FWS actually rejected some of the petitioner's allegations as being unsupported by reliable information. See Tucson Shovel-Nosed Snake 90-Day Finding, 73 Fed. Reg. at 43,910 (rejecting global climate change as adversely impacting the snake). In the Pygmy-Owl 90-day finding, in contrast, FWS accepted *every* assertion made in the Petition, often based on undisclosed "information in our files."

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threats in the 90-Day Finding, FWS ignored the fact that much of the current range of the Pygmy-Owl in Arizona is already protected.

Over 82 percent of the current Pygmy-Owl's range in Arizona is located within the Tohono O'odham Nation, national monuments, and wildlife refuges. WestLand Report at 2. Pygmy-Owl habitat is already protected from the alleged threats on these lands. The remaining 18 percent of the Pygmy-Owl's range consists of a mixture of private property, State Trust Lands, BLM lands, and other publicly held lands, much of which is not threatened by development or other intensive land uses. *Ibid*. 9

The other significant threat identified in the Petition concerns the invasion of the Sonoran Desert by buffelgrass, which is purported to result in direct loss and fragmentation of Pygmy-Owl habitat. 90-Day Finding, 73 Fed, Reg. at 31,422. Although the spread of buffelgrass is a serious ecological issue, its potential to effect widespread changes to the Sonoran ecosystem is not well understood. More importantly, none of the cited materials address the relationship between buffelgrass and Pygmy-Owls, nor is there any evidence that buffelgrass is found in areas occupied by Pygmy-Owls. See Johnson and Carothers, Review and Rebuttal at 6-7.

To put this issue in context, the State of Sonora contains more than 70,000 square miles of land (45 million acres), much of which is unsuitable for Pygmy-Owls. *Id.* at 7. Without having scientific information that identifies where buffelgrass is located relative to areas occupied by Pygmy-Owl, simply asserting that 8 to 10 million acres of land might be impacted by buffelgrass is largely meaningless. Moreover, the suggestion, discussed in the 90-Day Finding, that buffelgrass could "cover up to 56 percent of Sonora" at an unknown future date (90-Day Finding, 73 Fed, Reg. at 31422) is preposterous; that would be equivalent to more than 23 million acres of land – an area the size of Indiana.

Consequently, while buffelgrass may be affecting portions of Sonora and southern Arizona, the validity of this threat to the Pygmy-Owl is speculative. As Johnson and Carothers have explained, Sonora contains some 45 million acres of land, and without specific information

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⁹ Notably, northwest Tucson is outside of the Pygmy-Owl's current range in Arizona, which is located south and west of Interstate 10. *Id.* at 2-3, Fig. 2. As Johnson and Carothers have explained, northwest Tucson is unsuitable as Pygmy-Owl habitat. Johnson and Carothers 2007 at 13-14; Johnson and Carothers, *Distributional History* at 11-12; Johnson and Carothers, *Review and Rebuttal* at 9-10.

¹⁰ This discussion, although extremely vague, suggests that a significant portion of the area that may be affected by buffelgrass is not suitable for Pygmy-Owls. Although the author predicts that 56 percent of Sonora could be covered by buffelgrass, much lower percentages are predicted for desertscrub, woodlands and tropical deciduous forest. *Id.* Thus, many of the affected areas apparently are not within suitable Pygmy-Owl habitat. Clear, more work is needed before any conclusions can be reached concerning the impact of buffelgrass on the Pygmy-Owl.

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regarding the location and types of vegetation being affected, and whether those areas are occupied by Pygmy-Owls, the nature of this threat cannot be accurately assessed. As previously stated, Pygmy-Owls were readily found in suitable habitat throughout Sonora last spring, indicating that the Pygmy-Owls are currently widespread in Sonora. WestLand Report at 9. Given the lack of evidence of any population decline in Sonora, despite the presence of buffelgrass for several decades (*see*, *e.g.*, Listing Rule, 62 Fed. Reg. at 10,741), this threat certainly appears exaggerated. *See* Johnson and Carothers, *Review and Rebuttal* at 7.¹¹

(d) The Pygmy-Owl's Current Range Has Been Ignored

The range of G. b. catorum extends from southern Arizona south to the States of Colima and Michoacan. Cartron, et al., supra, at 5-7. Without explanation or citation, Petitioners ignored the status of the species south of central Sonora and moved the southern boundary of the species' range to southern Sinaloa or northern Nayarit. Petition at 3. The range should not be adjusted absent a credible scientific basis for doing so. Until then, FWS should evaluate the status of the Pygmy-Owl throughout its entire range, including the States of Sinaloa, Nayarit, Jalisco, Colima and Michoacan, rather than arbitrarily considering the status only in southern Arizona and northern Sonora.

It appears that FWS may again be considering some sort of "Sonoran Desert Population," which is an amorphous, non-biological construct that lacks any credible scientific basis. Johnson and Carothers 2007 at 4-7; Johnson and Carothers, *Distributional History* at 7; Johnson and Carothers, *Review and Rebuttal* at 4-6. As Johnson and Carothers explain, the so-called "Sonoran Desert Population" is not restricted to the Sonoran Desert and, in fact, spans an area that includes at least three different biomes (major natural communities). Johnson and Carothers 2007 at 6. Rather, the Pygmy-Owl is part of a larger faunal community that extends across multiple biomes from Arizona south through Mexico. *Ibid.* Throughout this area, there are common animal and plant species, including birds that are widespread in both Sinaloa and Sonora, and range into southern Arizona. Johnson and Carothers 2007 at 6-7. There is simply no distinct break, whether evaluated in terms of vegetation or wildlife, as the Petition simplistically contends. Any contrary conclusion must ignore the best available and instead focus on non-biological factors and motives.

The Petition also erroneously suggested that the range of the subspecies G. b. ridgwayi extends north into the Pacific lowlands. Petition at 3. No previous ornithological work has suggested the occurrence of that subspecies in the central Pacific lowlands. See, e.g., W.J. Schaldach, Jr., The avifauna of Colima and adjacent Jalisco, Mexico (1963) (discussing G. b.

We will not address FWS's determination that the partial construction of fence along portions of the border between Arizona and Sonora is a threat to the Pygmy-Owl (90-Day Finding, 73 Fed, Reg. at 31,423), and will instead rely on the agency to recognize on its own the absurdity of this determination, given the location of the fence, the likelihood of its completion, and the fact that Pygmy-Owls can fly.

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cactorum in Colima and Jalisco); A.R. Phillips, Further Systematic Notes on Mexican Birds (1966) (discussing differences between G. b. cactorum and G. b. intermedium, but never mentioning G. b. ridgwayi in Pacific lowlands). There may be additional subspecies of ferruginous pygmy-owls in southwestern Mexico, such as G. b. intermedium and G. b. saturatum. Johnson and Carothers 2008 at 11. However, the Petition fails to present evidence establishing that the Pygmy-Owl's range extends only to Nayarit, or that the range G. b. ridgwayi extends north along the central Pacific lowlands. Nor have Petitioners addressed the taxonomic revisions necessary for other ferruginous pygmy-owl subspecies, such as G. b. intermedium and G. b. saturatum.

In short, it is apparent that Petitioners simply ignored the accepted science concerning the Pygmy-Owl's range and taxonomy. FWS, however, is not free to ignore this scientific information, as it did in its 90-Day Finding. Indeed, FWS has consistently rejected attempts to revise the taxonomy of species absent a clear consensus in the scientific community, as the examples of the Tucson shovel-nosed snake, Preble's meadow jumping mouse and Pima pineapple cactus show.

4. Conclusion

The Petitioners requested listing of *G. r. cactorum* – a non-existent subspecies – as endangered or threatened under the ESA. Surprisingly, although the Petition was based upon speculative and untested science regarding the taxonomy of the Pygmy-Owl, FWS concluded the Petition presented substantial information that listing of the *G. r. cactorum* may be warranted. But the accepted taxonomy and the best available science confirms the *G. r. cactorum* does not exist, the Pygmy-Owl (*G. b. cactorum*) is thriving in Mexico, and few threats actually exist within its current range in southern Arizona. FWS should deny the Petition because the subspecies *G. r. cactorum* does not exist and because the best available science demonstrates listing of the Pygmy-Owl is not warranted.

SAHBA appreciates the opportunity to provide comments on the 90-Day Finding and looks forward to working with FWS to address the referenced deficiencies prior to publication of the 12-month finding on the current status of *G. b. cactorum*.

Very truly yours,

FENNEMORE CRAIG, P.C.

Norman D. James Jun

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cc: Mr. Steve Spangle (w/encl.)

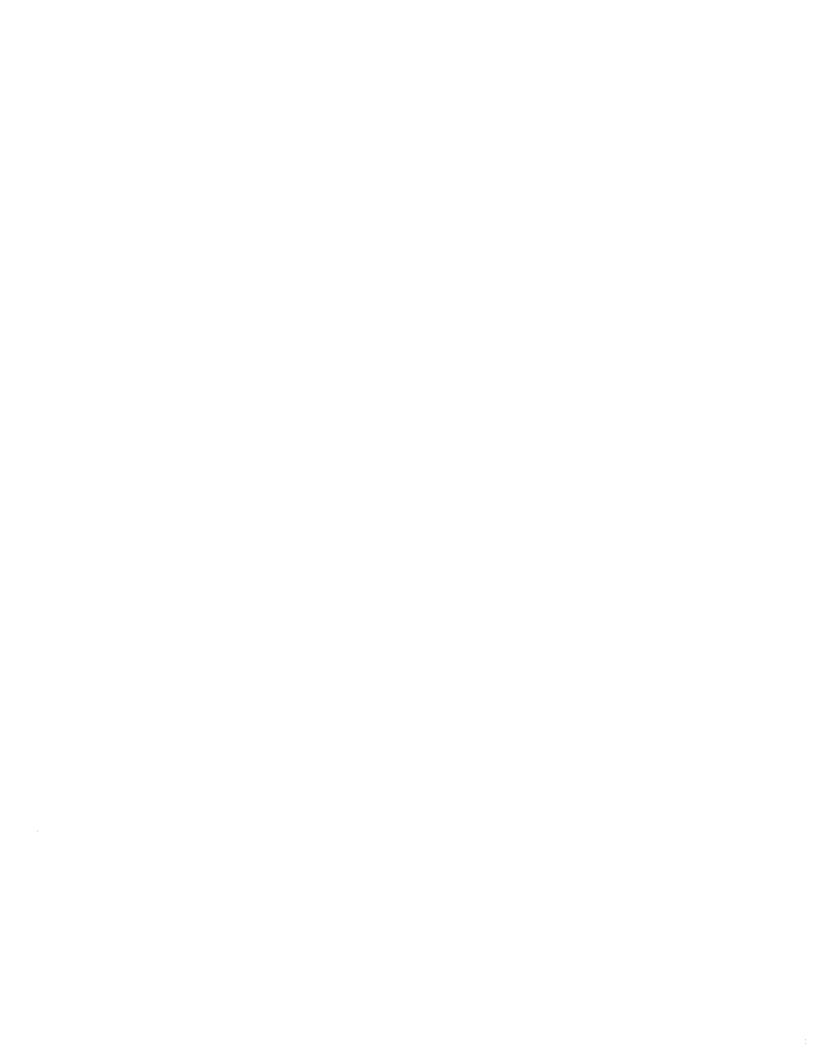
Field Supervisor

U.S. Fish and Wildlife Service Arizona Ecological Services Office

Mr. Edward Taczanowsky

Southern Arizona Home Builders Association

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A SCIENTIFIC ANALYSIS OF THE MARCH 15, 2007, PETITION AND THE JUNE 2, 2008, 90-DAY FINDING ON A PETITION TO LIST THE CACTUS FERRUGINOUS PYGMY-OWL AS A THREATENED OR ENDANGERED SPECIES

R. Roy Johnson, Ph.D. and Steven W. Carothers, Ph.D. 2

August 2008

Abstract: This paper is submitted in response to the Service's request in their 90-Day Finding for input related to the genetics and taxonomy of Ferruginous Pygmy-Owls (FPO), as well as for input related to the designation of critical habitat should the Cactus Ferruginous Pygmy-Owl (CFPO) be relisted. The authors review the appropriateness of the suggested change in nomenclature of the species/subspecies complex from Glaucidium brasilianum cactorum to Glaucidium ridgwayi cactorum. Issues related to past and possible future critical habitat designations for the subspecies are also discussed.

The Petitioners and the 90-Day Finding use an unofficial name for the CFPO, Glaucidium ridgwayi cactorum, instead of the accepted name, Glaucidium brasilianum cactorum, leading to confusion and disregarding the scientifically accepted North American, Middle American, South American, and international protocols for classifying and naming birds. The 90-Day Finding accepted the newly proposed classification, which is based primarily on DNA analysis, without taking into account other biological characteristics considered to be important factors used in owl classification and taxonomy. It is the authors' opinion that the Service has unnecessarily relegated to itself an authority that the ornithological community, by long tradition, has vested elsewhere. Through the mechanism of Distinct Population Segments, the Service has the legal authority to list any population of FPOs that meet Endangered Species Act listing criteria without dabbling in the business of changing ornithological taxonomy and nomenclature. The CFPOs in Arizona were once listed under the name Glaucidium brasilianum cactorum. Because the Service's jurisdiction does not extend into Mexico, the Petition and the 90-Day Finding are really about relisting the very same Arizona owls. To change the name of those owls to Glaucidium ridgwayi cactorum concurrent with relisting deliberations serves no practical purpose, introduces confusion, and casts doubt on the Service's scientific credibility.

The proposed CFPO critical habitat designation that was withdrawn by the Service on April 14, 2006 (71 FR 19452) comprised 1,208,001 acres divided into five critical habitat units in Pima and Pinal Counties, Arizona. Most of this vast area is upland Sonoran Desertscrub, which is not now, and, in our judgment, never was and never will be, occupied by CFPOs. It is our opinion that Arizona's upland Sonoran Desertscrub, in the absence of riparian and xeroriparian vegetation, does not provide the primary constituent elements that are essential to the conservation of the species; thus, the past and any future designation of such habitat as critical habitat for the CFPO was and would be unjustified and inappropriate.

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1.0 INTRODUCTION

This document presents a scientific analysis of a petition submitted by the Center for Biological Diversity and Defenders of Wildlife (Petitioners) to the U.S. Fish and Wildlife Service (Service) on March 15, 2007 (hereafter referred to as the Petition), and the responding 90-Day Finding on the Petition by the Service (73 FR 31418–31424) dated June 2, 2008. The Petition proposes the listing of one of the following entities of Cactus Ferruginous Pygmy-Owl (CFPO): 1) the Arizona distinct population segment (DPS) of the Cactus Ferruginous Pygmy-Owl; 2) the Sonoran Desert DPS of the Cactus Ferruginous Pygmy-Owl; or 3) the western subspecies of Cactus Ferruginous Pygmy-Owl as a threatened or endangered species under the Endangered Species Act (ESA), 16 USC §§ 1531–1544. The Petitioners also seek emergency protection for any of the three petitioned pygmy-owl entities and designation of critical habitat concurrent with any listing decision. In their petition, the Petitioners suggest a taxonomic and nomenclatural revision of the Ferruginous Pygmy-Owl (FPO), referring to the FPOs occurring in Arizona and northwestern Mexico as Glaucidium ridgwayi cactorum rather than Glaucidium brasilianum cactorum, the name sanctioned by the American Omithologists' Union (AOU) and the one used in all previous federal actions related to these owls.

In its 90-Day Finding, the Service found that listing the pygmy-owl may be warranted and announced that it has initiated a 12-month status review of the species. Stating that a taxonomic revision may be warranted, the Service referred to the FPO as *G. ridgwayi* rather than the more universally accepted *G. brasilianum*. The Service also invited comments on the 90-Day Finding and specifically requested input related to the genetics and taxonomy of FPOs, as well as input related to the designation of critical habitat if the species is proposed for listing.

1.1 Previous Federal Actions

The Arizona DPS of the CFPO (Glaucidium brasilianum cactorum) was listed by the Service as endangered on March 10, 1997 (62 FR 10730), with critical habitat designated on July 12, 1999 (64 FR 37419). That critical habitat designation was vacated by court order on September 21, 2001, and a proposed rule to designate new critical habitat was published on November 27, 2002 (67 FR 7102). As a result of a U.S. Court of Appeals for the Ninth Circuit opinion issued on August 19, 2003 (National Association of Home Builders v. Norton, 340 F. 3d 835, 852 (9th Cir. 2003)), the Service reassessed the application of the DPS significance. They found that, based on the available information and science, the Arizona DPS of the CFPO does not qualify as an entity that can be listed under the ESA. Accordingly, on April 14, 2006, the Service removed the Arizona population of CFPOs from the endangered species list, removed the critical habitat designation for this population at 50 CFR 17.95, and withdrew the proposed rule to designate new critical habitat (71 FR 19452).

1.2 Focus of This Report

The authors previously prepared a critique of the Petition (Johnson and Carothers 2007) that was submitted to the Service in May 2007. That report focused on the problems associated with listing the "Sonoran Desert DPS" of the CFPO (the second CFPO category proposed for listing in the Petition) as threatened or endangered under the ESA. It is our opinion that little new scientific

information relevant to that topic has become available since we produced the May 2007 report. In that report, we presented numerous instances where the scientific evidence ran contrary to the Petitioner's claims. It is also our opinion that the Service did not address the majority of the points we made. Therefore, rather than repeating our previous comments here, we have attached Johnson and Carothers 2007 to this document as Attachment A.

Problems associated with listing the other population categories identified by the Petitioners (the "Arizona population" and the "western population") were also discussed in reports previously submitted to the Service (Johnson and Carothers 2003a, 2003b, 2003c, 2005a, 2005b). The contents of those reports are incorporated into this document by reference; points raised in those reports are not repeated here unless they are critical to an understanding of the Petition and/or the 90-Day Finding, especially an understanding of the full implications, shortcomings, and misconceptions in either or both of those documents.

In this paper we focus on Petitioners' use, and the Service's inappropriate acceptance of unorthodox, and, in our opinion, poorly justified revisions of FPO nomenclature and taxonomy. Also, because the service specifically requested comments regarding designation of critical habitat should the CFPO be relisted, we briefly revisit the issue of designating critical habitat for the CFPO in Arizona.

2.0 CONFUSION BETWEEN SPECIES AND SUBSPECIES

The use of the name Glaucidium ridgwayi cactorum for the FPOs in western Mexico and Arizona and the name Glaucidium ridgwayi ridgwayi for the FPOs in eastern Mexico and Texas constitutes a revision of accepted nomenclature at the species level (from Glaucidium brasilianum to Glaucidium ridgwayi). Yet, as illustrated in the quotations provided below, the Service in its 90-Day Finding refers to this usage as a revision at the subspecies level.

The petitioners request a revised taxonomic consideration for the cactus ferruginous pygmy-owl based on Proudfoot et al. (2006a, p. 9; 2006b, p. 946) and König et al. (1999, pp. 160, 370–373), classifying it as <u>Glaucidium ridgwayi cactorum</u>. The revised consideration would include recognition of two subspecies in Mexico and the U.S., <u>G. r. cactorum</u> in western Mexico and Arizona and <u>G. r. ridgwayi</u> in eastern Mexico and Texas. We find this request to be reasonable, as Proudfoot and Johnson (2000, p. 4) indicate that a thorough taxonomic revision for the ferruginous pygmy-owl is needed. Other authors have also proposed the "<u>ridgwayi</u>" classification of the subspecies of pygmy-owl in question (Heidrich et al. 1995, pp. 37–39; Navarro-Sigüenza and Peterson 2004, p. 5). (73 FR 31420)

Some have suggested that the proposed taxonomic change should not be accepted until it is acknowledged by the American Ornithologist's Union (AOU) (Johnson and Carothers 2007, pp. 16–17). While the AOU checklist undergoes vigorous review, it presently does not list entries at the subspecies level and does not provide the most current information related to taxonomic classifications at this level (AOU 2007). (73 FR 31421)

In our opinion, the Service's language diminishes the significance of the suggested revision and serves to dismiss, ignore, or deny the role of the AOU as final arbiter of North American omithological classification and nomenclature. The Service also failed to address the public comment ("the proposed taxonomic change should not be accepted until it is acknowledged by the AOU") by first misrepresenting the proposed taxonomic change as one occurring only at the subspecies level, and then addressing the misrepresentation rather than the concern (i.e., setting up a "straw man," then knocking it down).

To portray the suggested name change as occurring at the subspecies level is incorrect. In the proposed revision, the subspecies names remain cactorum and ridgwayi. As noted above, it is the species name that is changed, from G. brasilianum to G. ridgwayi. The FPO (Glaucidium brasilianum) has historically been considered to consist of approximately 12-15 subspecies, depending on whose classification one follows (Proudfoot and Johnson 2000). Two subspecies have been generally considered for North and Middle America, Glaucidium brasilianum ridgwayi and Glaucidium brasilianum cactorum, the latter often known as the Cactus Ferruginous Pvgmv-Owl (CFPO). The subspecies for the taxon in western Mexico and Arizona is cactorum, regardless of whether it is called Glaucidium brasilianum cactorum or Glaucidium ridgwayi cactorum. The subspecies for the taxon in eastern Mexico and Texas is ridgwayi, regardless of whether it is called Glaucidium brasilianum ridgwayi or Glaucidium ridgwayi ridgwayi. The name change suggested by the Petitioners (2007) and accepted by the Service may have caused the confusion between species and subspecies because the Petitioners have suggested using an existing, recognized subspecies name, ridgwayi, as both a species and subspecies name. Historically, this practice has been avoided when revising scientific nomenclature precisely to avoid confusion.

3.0 HISTORIC CONSISTENCY OF FPO TAXONOMY

The following statement on page 31420 of the Service's 90-Day Finding is inaccurate: "... the literature suggests that the taxonomy of the pygmy-owl has been inconsistent and ever-changing (Coues 1872, p. 370 [our Coues 1872a], Bendire 1888, p. 366; Fischer 1893, pp. 199–200; Gilman 1901 [sic, actually 1909], p. 145, Howell 1916, p. 211)." There is no inconsistency in taxonomy in any of the referenced papers, either suggested by the authors or otherwise. Instead there are changes in nomenclature completely independent from the taxonomy of the species (Table 1). This misunderstanding may arise from the fact that three different specific names were used for the species from the time Coues (1872a) published the first record for the U.S. until the presently accepted name of *G. brasilianum* (AOU 1886, 1895, 1910, 1931, 1957, 1983, 1998).

The name Glaucidium ferrugineum was used from 1872 into the early 1880s (Coues 1872a, 1872b; Baird et al. 1875; Brewster 1883). It was spelled incorrectly as G. ferrugineus by Aiken, from his 1876 trip to the upper Gila River, Arizona, and carried forward though his notes even though they were not published until much later (Aiken 1937). From the mid-1880s into the early 1900s, the name G. phalaenoides was used (Stephens 1885; Scott 1886; Bendire 1888, 1892; Fisher 1893; Gilman 1909; Kimball 1921). After that the currently accepted name of G. brasilianum was established. Further complicating the nomenclature are at least two publications that used the wrong scientific species names, and in at least one of those cases, misidentified the pygmy-owl in question. Howell (1916) listed his Arizona specimen as

Glaucidium gnoma ridgwayi. Thus, he used the wrong specific name, gnoma, which is the scientific name for the Northern Pygmy-Owl, but the correct subspecific name, ridgwayi—the correct name at that time because cactorum was not described until later (van Rossem 1937). Howell's specimen is a CFPO (Johnson et al. 2003). Another confusing record is that of Visher's (1910), a misidentification of (apparently) Northern Pygmy-Owls from the oaks (see Anderson 1972).

Table 1.—History of the American Ornithologists' Union (AOU) classification and nomenclature for the Ferruginous Pygmy-Owl (now *Glaucidium brasilianum*) in North America in reverse chronological order.¹

Scientific Name	Common Name	Publication
Glaucidium brasilianum [Name retained]	Ferruginous Pygmy-Owl [Name retained]	AOU (2000–2007) Check-list Supplements
Glaucidium brasilianum	Ferruginous Pygmy-Owl	AOU (1998) [7 th Check-list]
Glaucidium brasilianum	Ferruginous Pygmy-Owl	AOU (1983) [6 th Check-list]
Glaucidium brasilianum cactorum	Ferruginous Owl	AOU (1957) [5 th Check-list]
Glaucidium brasilianum cactorum (van Rossem 1937)	Ferruginous Pigmy [sic] Owl (van Rossem 1937)	AOU (1944) [19 th Supplement to AOU Check-list (added subspecies)]
Glaucidium brasilianum ridgwayi	Ferruginous Pygmy Owl	AOU (1931) [4 th Check-list]
Glaucidium phalaenoides	Ferruginous Pygmy Owl	AOU (1910) [3 rd Check-list]
Glaucidium phalaenoides	Ferruginous Pygmy Owl	AOU (1895) [2 nd Check-list]
Glaucidium phalaenoides	Ferruginous Pygmy Owl	AOU (1886) [1 st Check-list]

¹ Changes have been in nomenclature only except when the newly named subspecies *G. b. cactorum* was added (AOU 1944). The 1st through the 5th AOU Check-lists listed all species and subspecies for the U.S. and Canada. The 6th and 7th Check-lists (1) no longer listed subspecies, and (2) listed all species for Mexico and "Central America" ("Middle America" of Ridgway [1914]) as well as for the U.S. and Canada.

While there has been agreement (until recently) among ornithologists regarding the existence and range of a single species of FPO (Glaucidium brasilianum), there has been historic disagreement regarding the proper subspecies for the Texas and northeastern Mexican population of FPOs. After the fourth AOU check-list AOU (1931), the name G. b. ridgwayi was retained until a new subspecies, G. b. cactorum, was named for the northernmost population of the species (van Rossem 1937). This newly described subspecies was described from a "giant cactus grove between Empalme and Guaymas...Sonora, Mexico" (van Rossem 1937:27). Van Rossem restricted this new race to northwestern Mexico and Arizona. He specifically excluded the Texas population about which he wrote "they approximate very closely the measurements and tail characters of cactorum... in color they are best referred to ridgwayi (van Rossem 1937:27-28). The new subspecies was accepted in the 18th supplement to the check-list by the AOU Committee (1944:50) which followed van Rossem, giving its distribution as "southern Arizona to Nayarit, western Mexico."

After the AOU Committee's acceptance of van Rossem's G. b. cactorum (including the suggested restricted range of northwestern Mexico and Arizona) we find no further formal discussion of the subspecies, its range, etc. until the fifth AOU check-list (AOU 1957). That publication listed the subspecies, adding the Lower Rio Grande Valley, Texas, and northeastern Mexico to the range of

G. b. cactorum. This would suggest that the distribution of G. b. ridgwayi terminated in central Mexico while the two northward extensions of G. brasilianum (basically a lowland species throughout its range), one on the west side of the Sierra Madre and the other on the east side, are both G. b. cactorum. This interpretation of the distribution of the subspecies of G. brasilianum from central Mexico northward on both sides of the Sierras was followed by some of the country's leading taxonomists, including Oberholser (1974) and Friedmann et al. (1950). However, several ornithologists disagreed with this thesis, maintaining the restriction of G. b. cactorum to western Mexico and Arizona and referring to the FPO of eastern Mexico and Texas as G. b. ridgwayi. The latter omithologists included Peters (1940), Wolfe (1956), Howard and Moore (1980, 1984, 1991), Freethy (1992), and Clements (2007); see Table 1.

4.0 USE OF UNRECOGNIZED REVISIONS IN FPO TAXONOMY AND NOMENCLATURE

The Petitioners (2007) and the 90-Day Finding use an unofficial name for the CFPO, Glaucidium ridgwayi cactorum, instead of the accepted name, Glaucidium brasilianum cactorum, leading to confusion and disregarding the scientifically accepted North American, Middle American, South American, and international protocols for classifying and naming birds.

On page 31421 of the 90-Day Finding, the Service states that "a taxonomic revision [for these taxa] may be warranted." This language indicates that the Service realizes that the proposed taxonomic revision of the FPO and CFPO has yet to be accomplished and that, while the proposed revision may be warranted, by definition it also may not be warranted. The word "may" expresses uncertainty. The Service is aware that the taxonomy and nomenclature used in the Petition and the 90-Day Finding has not been approved by the scientific ornithological community through conventional mechanisms. Despite acknowledgment of the revision's unofficial status and doubts about its validity as expressed in the use of the word "may," the Service went ahead and adopted the Petitioners' terminology of Glaucidium ridgwayi, acting as though a taxonomic revision has already been accomplished. The Service is side-stepping a scientific convention that, for excellent reasons, has been in place for over 100 years.

Moreover, the Service has unnecessarily relegated to itself an authority that the ornithological community by long tradition has vested elsewhere. Through the mechanism of Distinct Population Segments, the Service has the legal authority to list any population of FPOs that meet ESA listing criteria without dabbling in the business of changing ornithological taxonomy and nomenclature. The FPOs in Arizona were once listed under the name Glaucidium brasilianum cactorum. Because the Service's jurisdiction does not extend into Mexico, the Petition and the 90-Day Finding are really about relisting the very same Arizona owls that for sound scientific reasons were delisted in 2006 (71 FR 19452). To change the name of those owls to Glaucidium ridgwayi cactorum concurrent with relisting deliberations serves no practical purpose, introduces confusion, and casts doubt on the Service's scientific credibility.

4.1 Recognized FPO Name and Taxonomy

According to the leading professional ornithological organization in North, Middle, and South America, the AOU (1998), the most recent official name for the Ferruginous Pygmy-Owl in

North America, as well as in Middle and South America, is *Glaucidium brasilianum* not *Glaucidium ridgwayi*. Supplements to update changes since the last official AOU checklist (1998) are published by AOU at intervals, currently July of each year. No supplement since the 1998 checklist has changed the official name of the Ferruginous Pygmy-Owl (AOU 2000, 2002, 2003, 2004, 2005, 2006, 2007).

For birds of the world, the most recent checklist (Clements 2007) was prepared by a combined panel of professional ornithologists under the leadership of Cornell University's Laboratory of Ornithology (one of the nation's leading professional institutions) and the American Birding Association, composed of professional ornithologists and amateur birders. This comprehensive checklist contains all subspecies (sometimes referred to as races) recognized by the international ornithological community as well as all world-wide avian species. It contains *cactorum* and *ridgwayi* as subspecies of *G. brasilianum*. The most recent world-wide ornithological handbook we find before Clements (2007) is by del Hoyo et al. (1999), which also lists the subspecies *cactorum* and *ridgwayi* under *G. brasilianum*.

In its 90-Day Finding, the Service stated that the AOU does not presently list entries at the subspecies level (73 FR 31421). That is correct. The last checklist of *subspecies* for North America north of Mexico published by AOU was in 1957. The following is the range given for *Glaucidium brasilianum cactorum* in that checklist: "South-central Arizona (Phoenix and Tucson, west to Agua Caliente), western and northwestern Sonora (Sonoyta) and lower Rio Grande Valley, Texas (Hidalgo County, Brownsville), south to Michoacan, Nuevo Leon, and Tamaulipas" (AOU 1957:282). While the AOU no longer lists species with subspecific designations, numerous other papers and checklists published since 1957 list subspecies as well as species and continue to recognize *Glaucidium brasilianum cactorum* (e.g., Howard and Moore 1980, 1984, 1991; del Hoyo et al. 1999; Clements 2007).

4.2 Invalid Scientific and Common Names for the CFPO

The idea for changing the name for the North American Ferruginous Pygmy-Owl to Glaucidium ridgwayi came from C. König, P. Heidrich, and associates (i.e., Heidrich et al. 1995, Heidrich and Wink 1998, König et al. 1999, Wink and Heidrich 1999). König et al. (1999) was referenced by G.A. Proudfoot and associates (Proudfoot and Slack 2001; Proudfoot et al. 2006a, 2006b). These references suggest the reclassification of North American FPOs based on mitochondrial DNA evidence. Navarro-Sigüenza and Peterson (2004) use the name Glaucidium ridgwayi, referencing König et al. (1999), but neither accept nor reject the suggested change (A.T. Peterson, e-mail to RRJ, dated 7/12/2008). At this point, the name Glaucidium ridgwayi has no official standing, either on an international or North American basis, and the scientific community at large has not agreed to the suggested change. Numerous checklists have been published that could have included the classification suggested by König and associates (Sibley and Monroe 1990, 1993; Monroe and Sibley 1993; del Hoyo et al. 1999; AOU 1998, 2000, 2002, 2003, 2004, 2005, 2006, 2007; Clements 2007; Remsen et al. in press). None has accepted Glaucidium ridgwayi.

4.2.1 Protocol for Revising Ornithological Taxonomy and Nomenclature

Within the scientific community, taxonomic revisions consist of at least three steps: (1) analysis of specimens and examination of literature by an FPO expert; (2) publication of the treatise in a peer reviewed publication, following the rules established by the International Commission on Zoological Nomenclature (1985); and (3) acceptance of the new classification system by the scientific ornithological community. For North American birds, this last step is accomplished through a decision by the American Ornithologist's Union (AOU) Committee on Classification and Nomenclature - North & Middle America, also called the North American Check-list Committee (NACC).

According to the AOU (2008) Web site:

The NACC operates on a proposal basis, in which proposals are submitted and reviewed for taxonomic changes, English name changes, acceptance of distributional records, and other items related to the charge of the committee. Proposals also may be submitted that argue against a change recommended in the literature. Proposals typically are submitted on a case-by-case basis. Although members of the committee submit most proposals, any non-member may submit a proposal for consideration by the committee. Proposals are submitted to the Chair of the committee, and sets of proposals are distributed periodically (two-three times per year) to the committee for discussion and voting. Occasionally, proposals are sent to non-member "experts" for comment. Proposals must receive a 2/3 favorable vote to pass. Proposals that do not pass may be resubmitted at a later date if additional data are published in favor of the proposal. ³

In making their decision, NACC members apply the rules of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1985), which governs scientific names for animals throughout the world (see Mayr 1969 for discussion and text of the Code). Classification and nomenclature is based on a variety of factors, including vocalizations, morphology, morphometrics (measurements), plumage patterns, behavior, molecular biology, distribution, and ecology. Official names for birds of North America are published by the AOU through periodic checklists containing standardized common and scientific names. The reason that avian common names are more often capitalized than names of other vertebrates is because of this standardization of common names by the AOU.

The following example demonstrates the rigorous peer review through which a newly proposed name must go. In this example, a new subspecies of the Ferruginous Pygmy-Owl, *Glaucidium brasilianum intermedium*, was proposed for the CFPO on the Pacific coast from near Las Varas, Nayarit, south to near Juchitan, Oaxaca, by A.R. Phillips (1966). Phillips was one of North America's leading ornithologists and the leading avian taxonomist in Mexico (Phillips 1986, 1991; Phillips et al. 1964). Phillips eventually named more than 150 new species and subspecies of birds (Dickerman and Parkes 1997), yet this newly proposed subspecies of Ferruginous Pygmy-Owl was not accepted by most ornithologists (Proudfoot and Johnson 2000).

³ No formal proposals to change FPO taxonomy and nomenclature have been submitted to the AOU.

4.3 Problems with the Proposed Reclassification of FPOs

4.3.1 Over-emphasis on DNA Evidence for Defining Species

The proposal for changing the name of the North American Ferruginous Pygmy-Owl to Glaucidium ridgwayi is overwhelmingly based on mitochondrial DNA evidence (Heidrich et al. 1995; Heidrich and Wink 1998; König et al. 1999; Wink and Heidrich 1999; Proudfoot and Slack 2001; Proudfoot et al. 2006a, 2006b). Heidrich et al. (1995) initiated the movement. They suggested a divergence between G. brasilianum and what they called "G. ridgwayi?," always using a question mark after the latter name, demonstrating uncertainty in this separation. They suggested G. ridgwayi? as a species (not a subspecies as stated in the Service's 90-Day Finding, page 31420) based on DNA analysis of a single specimen from Mexico. This is the only DNA evidence supporting the proposed separation we find in any of the following papers: König 1994, Heidrich et al. 1995, Heidrich and Wink 1998, König et al. 1999, and Wink and Heidrich 1999.

The 90-Day Finding accepted the newly proposed classification, which is based primarily on DNA analysis, without taking into account other classification systems that utilize other parameters. Other important factors that are normally used in owl classification include bioacoustical analysis (vocalizations), morphology and morphometrics (measurements), plumage patterns, behavior, ecology, distribution, and other factors.

Even those who propose and list other important factors in owl classification (e.g., König 1994, Heidrich et al. 1995, König et al. 1999) sometimes overemphasize DNA analysis. By treating DNA analysis as the only factor in determining species of *Glaucidium*, Heidrich et al. (1995) disregarded their own information and that of others (see also König 1994) regarding the importance of bioacoustical analyses and vocalizations in owl speciation. Vocalizations are inherited by owls, thus "taxonomically specific" (Heidrich et al. 1995:1) rather than learned as in many species, especially Passeriformes. In owls, calls remain relatively conservative from one generation to the next and are the major means of maintaining the pair bond and genetic separation between species.

In a major paper on Neotropical Pygmy (Glaucidium) and Screech Owls (Otus), König (1994) emphasized bioacoustical studies in owl taxonomy. In that paper he wrote that G. brasilianum "vocalizations show rather few individual variations [and] this rather common species reaches from Texas to central Argentina and Uruguay" (König 1994:3). He said little about DNA in his 1994 paper, despite the fact that four years earlier enough was known about DNA sequencing in birds to formulate a world-wide avian classification system based largely on DNA evidence (Sibley and Ahlquist 1990, Sibley and Monroe 1990, Monroe and Sibley 1993). Only after Heidrich et al. (1995) completed the DNA analysis of the single specimen mentioned above did König et al. (1999) report detecting a difference in the calls of North and South American populations of FPOs. They wrote that the male G. brasilianum utters a series of approximately 3 equally spaced notes/sec, usually with up to 20 or 30 notes/phrase, contrasting with their "G. ridgwayi," whose calls consist of 2½-3 notes/sec; notably, the number of notes/phrase was not included (König et al. 1999). This is a very slight difference and may be attributable to variations from individual to individual and even differences for the same individual, depending on the circumstances.

The work of the senior author of this document (RRJ) with the FPO in the U.S., Mexico, and South America has failed to detect this supposed difference between the two populations. He could not tell the difference between the calls of FPOs in Peru from those in Arizona. He used the same vocal whistle pattern to call up FPOs in the Peruvian Amazon that he used in the Arizona desert. To RRJ's ears the Arizona Glaucidium and those of the Peruvian Amazon lowlands are the same species. In addition to vocalizations, the behavior, territory size, and other factors for the Peruvian FPO were extremely similar to that of the species studied by RRJ at Organ Pipe Cactus National Monument in southern Arizona (Johnson and Haight 1984, 1985).

There is precedent for the scientific community to reject proposed classification changes based solely on DNA evidence. Recent revisions of New World Vultures (family Cathartidae) provide a case in point. In a classification system for birds of the world, Sibley and coworkers used DNA evidence for rearranging the entire avian classification system (Sibley and Ahlquist 1990, Sibley and Monroe 1990, Sibley and Monroe 1993, Monroe and Sibley 1993). One of the major changes was in the removal of New World vultures (Cathartidae) from the order Falconiformes (hawks and allies) where they had been previously placed by the AOU for more than 100 years (AOU 1886, 1895, 1910, 1931, 1957, 1983). The "Sibley" system placed New World vultures as a subfamily, Cathartinae, with long legged wading birds under the family Ciconiidae (storks and allies). The AOU (1998) basically adopted this reclassification; however, they used analyses of anatomy, morphology, and behavior (König 1982, Rea 1983), and chemical composition of the uropygial gland (Jacob 1983) in addition to genetic evidence. Then, in 2007, after "re-evaluation of the reasons for the earlier change" the AOU reconsidered and put the family Cathartidae back with the Falconiformes (AOU 2007:111). In both revisions, the AOU took into account a large number of factors besides DNA analyses.

4.3.2 Disregarding Conventions Governing Changes in Common and Scientific Names

Even if the proposed reclassification of *Glaucidium* were adopted by the scientific community, use of the names "Ferruginous Pygmy-Owl" for "*Glaucidium ridgwayi*" and "Cactus Ferruginous Pygmy-Owl" for "*Glaucidium ridgwayi cactorum*" by both the Petitioners and the Service would violate protocols and official policy of the AOU. Since the Service is suggesting not only a nomenclatural change but also as a taxonomic change, retaining the common name for a bird with a different scientific name is unconventional and confusing. König et al. (1999), realizing this, retained the common name "Ferruginous Pygmy-Owl" for the *Glaucidium brasilianum*, but suggested using the common name "Ridgway's Pygmy-Owl" for the newly proposed species, *Glaucidium ridgwayi* (König et al. 1999:372).

Accepted naming practice can best be illustrated by looking at avian species for which there have been authorized taxonomic and nomenclatural changes. Two species of *Pipilo* (towhees) will serve as examples. In the 6th AOU checklist (AOU 1983), *Pipilo erythrophthalmus* (Rufous-sided Towhee) was considered to be the "red-eyed towhee" that occurred throughout both the western and eastern United States. By the 7th AOU checklist (AOU 1998), the AOU Committee had split this single species into two species, eastern and western subspecies, *Pipilo erythrophthalmus* (Eastern Towhee) of the East and *P. maculatus* (Spotted Towhee) of the West, based on additional scientific evidence. Note that even though the same, former scientific name is used for

the eastern subspecies (following nomenclatural rules of priority), a different common name is now used. The previous name, Rufous-sided Towhee, is no longer used for either "new" species to avoid confusion.

A similar example is illustrated by another towhee. The 6th AOU checklist listed one species of Brown Towhee (*Pipilo fuscus*) which occurred throughout the western and southwestern U.S. and into northwestern Mexico. The West coast and Baja California segment of the species is separated from the population of southwestern U.S. and northwestern Mexico by several hundred miles of desert, in most cases. Thus, treating these two disjunct populations as two separate species rather than one had long been proposed (see Johnson and Haight 1996, Kunzmann et al. 2002). By the 7th AOU checklist (AOU 1998), the Committee split the single species into two species, the westernmost California Towhee (*Pipilo crissalis*) and Canyon Towhee (*P. fuscus*) of interior North America. Again, the scientific name is retained for the first-named species (following nomenclatural rules of priority), but the common names were changed with neither species now being called Brown Towhee to avoid confusion.

4.3.3 Failure to Take into Consideration Recently Proposed Subspecies

The Petitioners failed to take into consideration two subspecies of the FPO that have been described from western Mexico, G. b. saturatum and G. b. intermedium, whose ranges extend southward from G. b. cactorum. The first-described subspecies, G. b. saturatum is recognized by the two latest checklists that we find on birds of the world that list subspecies (del Hoyo et al. 1999, Clements 2007). Brodkorb (1941:1) gave the range for G. b. saturatum as "Pacific lowlands of the District of Soconusco in Chiapas and the adjacent part of Guatemala." This has special significance because in both del Hoyo et al. (1999) and Clements (2007) G. b. saturatum is placed, both geographically and taxonomically, between G. b. cactorum and G. b. ridgwayi.

It is impossible for us to tell if G. b. saturatum and G. b. intermedium are related in any way to the differentiation between specimens undergoing DNA analyses (Proudfoot and Slack 2001, Proudfoot 2006a, 2006b). Apparently neither the Petitioners (2007) nor the Service realize that G. b. saturatum has been gaining in recognition by the scientific ornithological community (del Hoyo et al. 1999, Clements 2007). Any reclassification of FPOs needs to take into consideration the subspecies saturatum, and intermedium. These proposed subspecies are of more than academic interest since the proposed ranges of both are south of, and apparently immediately adjacent to, that of cactorum.

4.3.4 Erroneous Habitat Descriptions

König et al. (1999) list a number of habitats for each of their two species. They attempt to draw a contrast in habitat types separating their *G. ridgwayi* from *G. brasilianum*. For *G. brasilianum* (their South American species), their first-listed habitat is mesic, tropical and subtropical forest, and the first three descriptors in which the species occurs are "clearings, forest edges, riverine forest" (König et al. 1999:371). By contrast, the first habitat type listed for *G. ridgwayi* (their North American species) is "semi-open areas with thorny scrub and giant cacti," adding terms such as "open landscapes" and "mostly dry woods," thereby denoting a species of arid and semi-arid environments (König et al. 1999:372).

These attempts to contrast the habitats of the two groups are misleading. A search of the literature shows a wide variety of habitats for both North and South Americans members of this group. Literature from both North and South America describe FPO habitat as various riverine and upland deciduous forest and evergreen forests, scrub, thickets, and similar vegetative terms. Even though the words river, riverine forest, etc. occur only under G. brasilianum for South America (König et al. 1999), much of the literature for North American populations of G. brasilianum also mentions rivers or riverine habitats. More than 20 of the >50 publications we have reviewed mention riverine or riparian habitat for the species in the U.S. and Mexico. In fact, in Arizona, all published and specimen records from the Gila and Salt River regions (north of the Tucson area) are from riparian habitats (Johnson et al. 2003). For Arizona and northwestern Mexico (subspecies cactorum), publications that give a first-hand account of the species occurring in habitats along perennial or intermittent streams include Bendire (1888, 1892), Brewster (1883), Fisher (1893), Breninger (1898), Gilman (1909), Aiken (1937), and Johnson and Simpson (1971). State lists, species lists, and other compilations (in contrast to firsthand accounts) mentioning riparian habitats include Swarth (1914), Phillips et al. (1964), Monson and Phillips et al. (1981), and Russell and Monson (1998).

A similar situation is true for Texas and northeastern Mexico. First-hand accounts of the subspecies G. b. ridgwayi in riparian habitats include Griscom and Crosby (1925), Wolfe (1956), Sutton (1972), Gehlbach et al. (1976), and several records from along the lower Rio Grande reported by Oberholser (1974) and other sources, e.g., American Birds, Field Notes, etc. References for Texas that report G. brasilianum from riparian habitats include Peterson (1960), Oberholser (1974), Rappole and Blacklock (1994), and Texas Ornithological Society (2004). Publications for Mexico and Middle America that report G. brasilianum from riverine habitats include Peterson and Chalif (1973) and Edwards (1998).

FPOs in both North and South America have been extensively documented in riparian environments. In 1989, RRJ spent 12 days along the Peruvian Amazon and its tributaries, finding FPOs common along many of the large streams (RRJ Field Notes). However, the species was never encountered away from a stream, despite RRJ's walking through several miles of upland habitat on numerous occasions in several localities in the Amazon rain forest. FPOs did, however, occur around clearings adjacent to streamside villages and agricultural areas, as they reportedly do throughout the American tropics, including Pacific swamp forests, jungles and mangrove swamps (Alden 1969, Binford 1989, Meyer de Schauensee 1970). A similar situation is reported from Venezuela where FPOs were observed only along waterways by Michael Cross (pers. comm.) during the several years he lived there.

We also take issue with König et al. (1999) identifying giant cacti as a major component of the habitat of their *G. ridgwayi* as a way of differentiating its habitat from that of the South American population of FPOs. In reality, throughout most of the range of the North American population of FPOs, not only are giant cacti not a major component of their habitat, no giant cacti exist at all in Texas, northeastern Mexico, and most of the remainder of Middle America where the species commonly occupies mesic rather than arid environments.

Another major shortcoming of both the Petition and the 90-Day Finding is the failure to mention tropical deciduous forest, which Russell and Monson (1998:141) found to be the most common habitat association for CFPOs. In Sonora, this vegetation type is prevalent near Alamos (Robichaux and Yetman 2000), where the CFPO is listed by Alden (1969) and Russell (2000). In Mexico, tropical deciduous forest continues from southern Sonora southward to Oaxaca (Binford 1989) and through Central America into Costa Rica (Stiles and Skutch 1989).

5.0 CONSIDERATIONS REGARDING ANY FUTURE DESIGNATION OF CRITICAL HABITAT IN ARIZONA

The proposed CFPO critical habitat designation that was withdrawn by the Service on April 14, 2006 (71 FR 19452) comprised 1,208,001 acres divided into five critical habitat units in Pima and Pinal Counties, Arizona. Most of this vast area is upland Sonoran Desertscrub, which is not now, and, in our judgment, never was and never will be, occupied by ferruginous pygmy-owls. It is our opinion that Arizona's upland Sonoran Desertscrub, in the absence of riparian or xeroriparian vegetation, does not provide the primary constituent elements that are essential to the conservation of the species; thus, the past and any future designation of such habitat as critical habitat for the CFPO was and would be unjustified and inappropriate. This opinion is based on the historical distribution of CFPOs in Arizona as evidenced by all known collection and observational records of the species' occurrence in the state. We presented an extensive case for this position in Johnson and Carothers 2003a and 2003b and incorporate these reports by reference into this document. We summarize only the principal points here and provide updated information.

Historical and recent records for the CFPO in Arizona indicate that (1) the ferruginous pygmy-owl was formerly an obligate wet riparian species in south-central Arizona and a preferential wet riparian species in southern Arizona; (2) recent upland Sonoran Desertscrub populations developed largely after the destruction of most of the lowland wet riparian ecosystems in Arizona; (3) most recent upland records for the species have been from xeroriparian ecosystems along desert washes or sparsely developed suburban areas where water and ornamental plantings have created "cultivated riparian" habitat, specifically northwest Tucson; and (4) cultivated riparian habitat in suburban areas can act as an ecological trap, as evidenced by both the occurrence and extirpation of CFPOs in northwest Tucson. These points are briefly discussed below.

The ferruginous pygmy-owl was formerly an obligate wet riparian species in south-central Arizona and a preferential wet riparian species in southern Arizona. For several decades after the CFPO's discovery in the U.S., specimen and published records for the owl in the Gila River region and Phoenix region (Salt River and tributaries) of Arizona were entirely from wet riparian habitats (Fisher 1893; Breninger 1898; Gilman 1909; Johnson et al. 2000, 2003). The record is similar for the rest of southern Arizona, including the Tucson region, where most early records were from Rillito Creek and tributaries (Johnson et al. 2003). If populations of CFPOs commonly inhabited upland habitats, the numerous cross-country expeditions conducted during the late 1800s and early 1900s should have uncovered them. They did not (Emory 1848; Baird 1859; Heermann 1859; Henshaw 1875a, 1875b; Bendire 1892; Audubon 1906; Mearns 1907; Aiken 1937).

A precipitous decline in the occurrence and distribution in Arizona of riparian avian species, including the CFPO, showed a close correlation with Anglo-European settlers' development of irrigated agriculture and urban water projects (Brandt 1951; Phillips and Monson 1964; Johnson et al. 1977, 1987; Johnson 1979; Hunter et al. 1987; Johnson and Simpson 1988; Millsap and Johnson 1988). CFPO populations along lowland streams of central Arizona were extirpated with the construction of large Bureau of Reclamation dams during the first half of the 1900s. The more recent establishment of populations of CFPO in xeroriparian and cultivated riparian habitats and upland Sonoran Desertscrub—or at least the discovery of these populations—occurred after the destruction of most of Arizona's wet riparian ecosystems during the late 1800s and early 1900s.

The xeroriparian/upland CFPOs have always been absent or rare. There is little to no evidence that the species was ever more numerous in these more newly occupied, non-wet riparian habitats than it was during the 1990s. In fact, the historical data are so strong linking the CFPO with wet riparian habitats that the first Service listing proposal (with critical habitat) in 1994 (59 FR 63975) emphasized wet riparian systems as essential to the conservation of the species. It was only after 1994 when the northwest Tucson CFPOs were found in association with human development in upland desert that the concept of designating vast acres of unoccupied upland desert as critical habitat was pursued by the Service.

In 1999 the northwest Tucson CFPO population included 17 breeding birds at 11 sites, with 16 young fledged (Abbate et al. 2000). It was at that time the largest known population in Arizona. By 2003 that population had declined to four individuals, and that population is now extinct. In 2003, Johnson and Carothers (2003a, 2003b) suggested that the low-density subdivisions of northwest Tucson area had become an "ecological trap" for the owls and predicted the eventual extirpation. An ecological trap is a situation where ecological conditions (e.g., vegetation, water, prey base) seem suitable and attract organisms, but populations gradually decline because of other factors (e.g., predation, pesticides, collisions with vehicles and structures). It has been said that ecological traps can occur "... when a novel element in the environment mimics a traditional cue for habitat choice, thereby misleading the organism" (Schlaepfer et al. 2002). We believe this is exactly what occurred in northwest Tucson. There were no records of CFPOs in the upland desert of that area before the subdivisions were built. In our opinion, the irrigated landscape of the subdivisions mimicked characteristics of the CFPOs' natural riparian habitat and attracted the owls. This being the case, designating large tracts of undeveloped upland desert as critical habitat, based primarily on the occurrence of CFPOs in Northwest Tucson, was misguided. We urge the Service not to make the same mistake again if CFPO's are relisted in the future.

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⁴ "Cultivated riparian habitat" is associated with human habitation, often consisting of a mixture of native vegetation and exotic trees, shrubs, and/or lawns, and irrigated agricultural fields.

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ATTACHMENT A

A SCIENTIFIC ANALYSIS OF THE MARCH 15, 2007, PETITION TO LIST THE CACTUS FERRUGINOUS PYGMY-OWL AS A THREATENED OR ENDANGERED SPECIES

R. Roy Johnson, Ph.D. and Steven W. Carothers, Ph.D.

May 2007

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R. Roy Johnson, Ph.D.5 and Steven W. Carothers, Ph.D.6

May 2007

1.0 INTRODUCTION

This document presents a scientific analysis of a petition submitted by the Center for Biological Diversity and Defenders of Wildlife to the U.S. Fish and Wildlife Service (Service) on March 15, 2007, to list one of the following entities of Cactus Ferruginous Pygmy-Owl: 1) the Arizona distinct population segment (DPS) of the Cactus Ferruginous Pygmy-Owl; 2) the Sonoran Desert DPS of the Cactus Ferruginous Pygmy-Owl; or 3) the western subspecies of Cactus Ferruginous Pygmy-Owl as a threatened or endangered species under the Endangered Species Act (ESA), 16 USC §§ 1531–1544. The petitioners also seek emergency protection for any of the three petitioned pygmy-owl entities and designation of critical habitat concurrent with any listing decision.

The Arizona DPS of the Cactus Ferruginous Pygmy-Owl (Glaucidium brasilianum cactorum; CFPO)—inappropriately referred to in the petition as Glaucidium ridgwayi cactorum—was listed as endangered on March 10, 1997 (62 FR 10730), with critical habitat designated on July 12, 1999 (64 FR 37419). As a result of a U.S. Court of Appeals for the Ninth Circuit opinion issued on August 19, 2003 (National Association of Home Builders v. Norton, 340 F. 3d 835, 852 (9th Cir. 2003)), the Service reassessed the application of the DPS significance. They found that, based on the available information and science, the Arizona DPS of the CFPO does not qualify as an entity that can be listed under the ESA. Accordingly, on April 14, 2006, the Service removed the Arizona population of pygmy-owls from the endangered species list and rescinded the critical habitat designation (71 FR 19452). It is the opinion of the authors of this report that no new scientific information has become available since the delisting in 2006 to contradict the Service's actions. Further, the attempt to list what the petitioners consider a distinct population segment within a portion of the population in Sonora violates taxonomic norms and is not supported by credible scientific study.

In their March 2007 petition to have the CFPO relisted, the petitioners claim that the Service failed to consider whether the Arizona population is significant to the taxon because it represents the only population of the CFPO in the continental U.S., or to consider whether another entity should be protected, including the population occupying both Arizona and Sonora, Mexico (the Sonoran Desert Population). They argue that the Sonoran Desert Population qualifies as a distinct population because it occurs in a unique ecological setting, its loss would result in a significant gap in the range of the species, and it is markedly different in its genetic characteristics. The

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petitioners also claim that the Service failed to consider protection for the western subspecies of the CFPO, which they believe is threatened or endangered in a significant portion of its range.

The petitioners argue that emergency listing is justified because the species in question "is threatened with imminent extinction in the U.S.," and designation of critical habitat is needed, in part, because the former critical habitat designation provided essential guidance in identifying development project mitigation standards under the Pima County government's Sonoran Desert Conservation Plan and Multiple Species Conservation Plan.

The analysis presented in this document focuses on the weaknesses the petitioners' arguments for listing their so-called "Sonoran Desert DPS" of the CFPO as threatened or endangered under the ESA. The authors previously addressed the problems associated with listing the other populations identified by the petitioners (the "Arizona population" and the "western population") as threatened or endangered distinct population segments in the following reports, previously submitted to the Service:

- Johnson, R.R., and S.W. Carothers. 2003a. A history of the occurrence and distribution of the Cactus Ferruginous Pygmy-Owl (Glaucidium brasilianum cactorum) in southern and central Arizona: A scientific analysis of a species at the edge of its range. June 13, 2003. Prepared by Johnson and Haight Environmental Consultants, Tucson, AZ, and SWCA Environmental Consultants, Flagstaff, AZ, for Fennemore Craig Tucson AZ.
- Johnson, R.R., and S.W. Carothers. 2003b. A review: Designation of critical habitat for the Arizona distinct population segment of the Cactus Ferruginous Pygmy-Owl (Glaucidium brasilianum cactorum), Proposed Rule, United States Fish and Wildlife Service. (Fed. Reg. 67 [229]: 71032-71064; Nov. 27, 2002). With Comments on Cactus Ferruginous Pygmy-Owl Draft Recovery Plan United States Fish and Wildlife Service (January 2003). July 2003. Prepared by Johnson and Haight Environmental Consultants, Tucson, AZ, and SWCA Environmental Consultants, Flagstaff, AZ, for Fennemore Craig, Tucson, AZ.
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- Johnson, R.R., and S.W. Carothers. 2005b. Comments on the proposed rule to remove the Arizona distinct population segment of the Cactus Ferruginous Pygmy-Owl from the federal list of endangered and threatened wildlife. September 5, 2005. Prepared by Johnson and Haight Environmental Consultants, Tucson, AZ, and SWCA Environmental Consultants, Flagstaff, AZ, for Fennemore Craig, Phoenix, AZ.

In the interest of brevity, all the points raised in the above reports are not repeated here, and the reader is encouraged to review these reports to obtain a more complete understanding of the CFPO's status.

In addition to analyzing the validity of the so-called "Sonoran Desert DPS" and addressing other weaknesses in the petitioners' case for listing a discrete population segment of the CFPO as

threatened or endangered, in this paper we explain why the petitioners' use of the name *Glaucidium ridgwayi* for the CFPO is inappropriate, and we summarize inaccuracies and misconceptions in the scientific literature that have fueled misunderstandings about the status of the CFPO in Arizona and Mexico.

2.0 WEAKNESSES IN PETITION ARGUMENTS

The petitioners argue that a population segment (either the pygmy-owls in Arizona, the pygmy-owls inhabiting the Sonora Desert in both Arizona and Sonora, Mexico, or the pygmy-owls that constitute the genetically distinct western population) of the CFPO should be listed because:

1. It occurs in a unique ecological setting, its loss would result in a significant gap in the range of the species, and it is markedly different in its genetic characteristics.

<u>Rebuttal</u>: As noted in the introduction to this paper, we have addressed problems with listing the Arizona population and the western population of CFPOs as distinct population segments in previous papers. In this document, we focus on reasons why the petitioners' "Sonoran Desert Population" fails to meet the discreteness test for eligibility for listing as a DPS. Among other reasons, the proposed DPS does not occupy a unique ecological setting, nor is it specific to the Sonoran Desert but ranges across at least three biomes. There is no break in the distribution of the CFPO in the western Mexican lowlands to justify DPS status based on geography, nor is there a sharp break in faunas or floras of the ecosystems these owls inhabit, nor are there significant genetic differences within the western population.

2. The CFPO is subject to present or threatened destruction, modification, or curtailment of its habitat or range.

In support of this contention, the petitioners claim that the CFPO was historically common in riparian woodlands across much of southern Arizona, but the 85% loss of the state's riparian areas has caused the pygmy-owl to largely disappear from the state's few remaining riverside forests.

Rebuttal: We agree that the loss of a very large percentage of riparian habitat (mainly to water storage and diversion projects prior to 1920) has resulted in the near disappearance of the pygmy-owl from its traditional habitats in Arizona. We disagree, however, that the CFPO was ever common in the state. While a few early observers did indicate that the bird was "of common occurrence" (Breninger 1989:128), "fairly numerous" (Gilman 1909:148), and "quite common" (Fisher 1893:199) in specific wet riparian habitats, the actual record of collections and reported observations of Arizona's avifauna, which we summarize in this paper, strongly suggest that then CFPO was in fact uncommon in the state as far back as historical records have been kept.

The petitioners go on to claim that, "today, the species is found in small numbers primarily in upland habitats, including Sonoran Desertscrub and semidesert grasslands, where it is threatened by urban development in both Arizona and Sonora, where human populations are rapidly expanding."

Rebuttal: We agree that the CFPO now occurs in small numbers in mainly upland habitats in the northern periphery of its range; however, we contend that the pygmy-owl did not make an inexplicable (from a biological point of view) change in its habitat preference from wet riparian to dry upland desert. We argue that recent records of CFPO occurrence in Arizona suggest that this subspecies has largely substituted artificial (human-made) water sources in upland desert surroundings for its traditional natural riparian habitats. We show in this paper that the largest known population of CFPOs in half a century appeared in suburban northwest Tucson in the 1970s, where landscaping and other human water uses support the vegetation and associated prey species needed by this subspecies. It is telling that there is no evidence that CFPOs occurred in that area when it was undeveloped, dry upland desert. The subsequent disappearance of those pygmy-owls from Tucson is widely used to support claims that urban development is a threat to the CFPO, and that upland desert areas need to be preserved to conserve this owl. Nothing is said in these claims that human development, like that in northwest Tucson, may actually attract CFPOs to areas they would not otherwise inhabit.

We provide evidence in this paper that, in the northern periphery of the CFPO's range, that is, in Arizona, this pygmy-owl did not traditionally occupy upland desert habitats and, for the most part, still does not. It is therefore unjustifiable to designate large tracts of such desert as critical habitat (in order to limit development in those tracts) when the CFPO does not, nor ever has, occupied such habitat in this part of its range. Restricting development in upland desert in Arizona may help to conserve some species, but it is unlikely that the CFPO is among them.

3. The CFPO is subject to other natural or manmade factors affecting the continued existence of the species.

<u>Rebuttal</u>: In this section of the petition, the petitioners claim that, in Sonora, the CFPO population is declining. This conclusion is largely based on the work of Flesch and Steidl (2006). In this paper we point out that the methods used by these researchers are unconventional and cast doubt on the validity of their results.

2.1 The "Sonoran Desert Population" Does Not Meet the Discreteness Test for Listing as a Distinct Population Segment

The so-called "Sonoran Desert Population" of the CFPO, advocated by the petitioners as a distinct population segment (DPS), is an artificial, invalid grouping. To be listed as a DPS, a population must be discrete, which means 1) the population is markedly separated from other populations of the same taxon; or 2) the population is delimited "by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist" (61 FR 4722). The population of CFPO that occupies the Sonoran Desert in Arizona and Sonora, Mexico, meets neither of these criteria for discreteness. Obviously, the "Sonoran Desert Population" of CFPO extends across the U.S.-Mexico boundary and does not satisfy the second criterion. This "population" also does not satisfy the first criterion because there is no break in the distribution of the CFPO in the western Mexican lowlands and no

sharp break in faunas or floras of the ecosystems it inhabits. It is therefore illogical and invalid to propose an artificial break and to differentiate between a "Sonoran Desert Population" of the CFPO from others to the south.

The "Sonoran Desert Population" Represents an Artificial Break in a Continuous Distribution. The CFPO shows a continuous distribution in western Mexico, between the Sierra Madre Occidental to the east and Pacific coast to the west, and from Arizona, south through Sonora and Sinoloa, continuing southward through Central America. Thus, the petitioners' "Sonoran Desert Population" of the CFPO constitutes an artificial break in this continuous distribution. Range maps and distribution descriptions for Mexican birds, owls, etc., show a continuous distribution for the CFPO from northern Mexico into Central America (Friedmann et al. 1950, Blake 1953, Grossman and Hamlet 1964, Davis 1972, Peterson and Chalif 1973, Burton 1984, Ginn 1984, Edwards 1989, Howell and Webb 1995, American Ornithologists' Union [AOU] 1998, Proudfoot and Johnson 2000).

The "Sonoran Desert Population" Is Not Restricted to the Sonoran Desert or Particularly Representative of Sonoran Desert Fauna. Claiming that there is a "Sonoran Desert Population" of CFPO that meets the criteria for listing as a DPS fails to acknowledge that the CFPO is not restricted to the Sonoran Desert but occurs in a wide variety of vegetation types (Brown 1982, 1994). There is nothing "discrete" about those pygmy-owls owls that occur in the Sonora Desert. In fact, the CFPO inhabits at least three biomes (major natural communities, each characterized by a distinctive vegetation type). From north to south, these biomes are (1) Sonoran Desertscrub, (2) Sinaloan Thornscrub, and (3) Tropical Deciduous Forest. The definitive work on birds of Sonora, Mexico (Russell and Monson 1998) shows the CFPO occurring throughout that state and notes it "is resident throughout most of the desertscrub, thornscrub, and tropical deciduous forest" (Russell and Monson 1998:141).

The CFPOs That Occur in the Sonoran Desert Are Not Genetically Distinct from CFPOs in Other Biomes. Recent mitochondrial DNA work found that the genetics of CFPOs in Sonoran Desertscrub, Sinaloan Thomscrub, and Tropical Deciduous Forest are similar, precluding the designation of a "Sonoran Desert Population" based on genetic analysis (Proudfoot and Slack 2001, Proudfoot et al. 2006). "Populations from Arizona, Sonora, and Sinaloa are genetically distinct [from]... populations occurring in Texas and other regions of Mexico" (Proudfoot et al. 2006:1).

The type specimen for *Glaucidium brasilianum cactorum*, the CFPO, was taken between Guaymas and Empalme, in the southern half of Sonora (van Rossem 1937, AOU 1957). This is approximately 240 mi south of the boundary between Sonora and Arizona but only 125 mi north of Tropical Deciduous Forest = Sinaloan Deciduous Forest of Brown and Lowe (1980). In addition, less than 10 mi east of Guaymas one encounters Sinaloan Thorncrub. More sophisticated genetic analysis would probably show that the type CFPO is more closely related to populations in Tropical Deciduous Forest and Sinaloan Thorncrub than the so-called "Sonoran Desert Population." This all negates the idea of a "Sonoran Desert Population" of the CFPO as a distinct population segment.

The CFPO Is Part of a Larger Faunal Community That Extends across Multiple Biomes in Arizona and Mexico. The continuous distribution of the CFPO, from southern Arizona and northern Sonora, Mexico, southward throughout the lowlands of western Mexico, is shared by a large number of other animal species, especially birds. There is no sharp break in this fauna between the Sonoran Desert and contiguous areas in the American tropics to the south, e.g., Sinaloan Thornscrub and Sinaloan Deciduous Forest. A high percentage of the animals that occur in the Sonoran Desert also occur in these adjacent, more southerly biomes.

Other species that have a named subspecies whose distribution extends from Arizona, south through the west Mexican lowlands and through numerous vegetation types include the Gray Hawk (Asturina nitidus plagiata), Inca Dove (Columbina inca), Northern Beardless-Tyrannulet (Camptostoma imberbe ridgwayi), Tropical Kingbird (Tyrannus melancholicus satrapa), to name a few (Friedmann et al. 1950, AOU 1957, 1998; Miller et al. 1957, Howell and Webb 1995, Stouffer and Chesser 1998, Tenney 2000, Bibles et al. 2002).

Of the 57 species of higher order, common and abundant breeding birds listed for Tropical Deciduous Forest (Russell 2000), 46 song birds (Passeriformes) and 4 woodpeckers (Piciformes) also occur in Arizona. Thus 87.7% of avian species commonly breeding in Tropical Deciduous Forest of southern Sonora and northern Sinaloa also breed in Arizona (Phillips et al. 1964, Monson and Phillips 1981, Corman and Wise-Cervais 2005). Of the ten species of birds (including the CFPO) listed for Sinaloan Thornscrub by Brown (1982, 1994), only two do not occur in the Sonoran Desert. The other eight species occur northward to at least southern Arizona.

Plant Species Overlap Ecosystems Inhabited by the CFPO. There is no sharp break in the flora (plant species) of the lowlands of western Mexico between southern Arizona and Sinaloa, Mexico. Vegetation changes gradually from north to south, from the Sonoran Desert in Arizona, through the Sonoran Desert in Sonora, Mexico, into the Sinaloan Thornscrub and, finally, into the Tropical Deciduous Forest of southern Sonora and Sinaloa.

Plant species that are directly important or that are components of ecosystems important to the CFPO, occurring in southern Arizona and northern Sonora, also occur in Sinaloan Thornscrub (Bowers 1980, Brown 1982, 1994; Tibbitts and Dickson 1999). These include ironwood (Olney tesota), velvet mesquite (Prosopis juliflora), acacias (Acacia spp.), blue palo verde (Cercidium floridum), desert hackberry (Celtis pallida), graythom (Ziziphus obtusifolia), and numerous others. Several of these, and closely related plant species, also occur farther south, in Tropical Deciduous Forest (Martin et al. 1998, Van Devender et al. 2000).

Of the 90 plant species listed for the Sinaloan Thornscrub by Brown (1982, 1994) only 2 (2.2%) are restricted to Sinaloan Thornscrub. The other 88 species occur to some degree in the Sonoran Desert to the north. Of these 88 species, 36 (40%) extend northward into Arizona. In addition, many of these same species, occurring in the Sonoran Desert, continue south through Sinaloan Thornscrub and into Tropical Deciduous Forest (Martin et al. 1998, Van Devender et al. 2000).

Shreve, the leading expert on North American Deserts, especially the Sonoran Desert, designated 31 "Characteristic Species" for the Sonoran Desert (excluding those restricted to Baja

California). Of these 31 species, 23 (74.2%) occur in both the Sonoran Desert and the Sinaloan Thornscrub of southern Sonora, Mexico (Shreve 1951, Shreve and Wiggins 1964). These species are so prevalent that many are commonly seen from the road as one drives southward through western Mexico (Mason and Mason 1987). Also, 21 (67.7%) of these 31 species occur from the Sonoran Desert of southern Arizona, south through the Sonoran Desert of northern Mexico and into the Sinaloan Thornscrub. Additionally, 15 (48.4%) of these Characteristic Species of the Sonoran Desert occur in the second biome south of the Sonoran Desert, Tropical Deciduous Forest (Martin et al. 1998, Van Devender et al. 2000).

The Sinaloan Thomscrub of Brown and Lowe (1980) and Brown et al. (1979, 1980) was originally designated as the Foothills of Sonora as part of the Sonoran Desert by Shreve (1951). The continuation of so many plant species from Sonoran Desertscrub, southward into what is now know as Sinaloan Thomscrub, are among the factors that led Shreve to his decision.

2.2 Low and Declining CFPO Population Numbers in Arizona Are More Likely a Function of Its Position at the Extreme Edges of Its Range and Large-scale Historical Water Development Than of Urban and Suburban Development

Most concern over the low and apparently declining numbers of CFPO recorded in Arizona recently has focused on the impact of the rapidly growing urban and suburban development in southern Arizona. However, historical records of the CFPO's distribution, habitat preferences, and changing population numbers suggest that forces other than urban and suburban development have had more profound effects on this subspecies. The key concept underlying all these forces is the fact that Arizona lies at the extreme northern and western edge of the CFPO's range. A record of the CFPO at New River in south-central Arizona (Fisher 1893) represents the northernmost known occurrence of this subspecies and for the species as a whole (Proudfoot and Johnson 2000), while the Agua Caliente records (Gilman 1909, Johnson et al. 2003) and Cabeza Prieta Tanks record are the westernmost records for the species (Monson 1955). Habitats to the north and west of these locations clearly have not been suitable for the CFPO as long as ornithological records have been kept, and the relatively sparse records within Arizona suggest that even occupied habitat was and is marginal and localized. Arizona's position at the periphery of the CFPO's range has several implications, including the bird's historical and recent habitat preferences in Arizona; fluctuations in CFPO abundance in Arizona over time; and lower population numbers in Arizona relative to abundances in the more southerly portions of the CFPO's range.

The Preferred Habitat of the CFPO in the Northern and Western Limits of its Range Is Riparian and Xeroriparian Environments. Historically, the preferred habitat of the CFPO at the northern and western limits of its range has been wet riparian ecosystems (see the review of historical records later in this paper). Xeroriparian ecosystems, which includes dry wash vegetation, constitute a secondary habitat. No early CFPO records exist from upland Sonoran Desertscrub in Arizona, suggesting this habitat is not suitable for CFPOs at the northern extreme of its range (discussed at greater length later in this paper).

The deciduous Riparian Gallery Forests (cottonwood-willow [Populus-Salix] and others) along perennial and intermittent streams of southern Arizona structurally resemble the Tropical

Deciduous Forest of more southerly reaches of the CFPO's range. It is not surprising, then, that all northern peripheral records (north of Tucson) were from near water. Record locations include New River (Fisher 1893), Cave Creek (Johnson et al. 2003), and Salt River (Breninger 1898, Johnson et al. 2003) from the Phoenix region; the upper Gila near Ft. Thomas (Aiken 1937); the middle Gila on the Gila River Indian Reservation (Gilman 1909, Rea 1983); the lower Gila at Agua Caliente (Gilman 1909, Johnson et al. 2003); and Gale Monson's (1955) westernmost record at Cabeza Prieta Tank.

When Arizona experienced a major loss of wet riparian habitat in the early 1900s due to water projects, e.g., large reclamation dams and diversions for mining, livestock, municipalities, and other human uses, CFPO populations precipitously declined (Johnson et al. 2000, Johnson et al. 2003). Currently, xeroriparian ecosystems (primarily along washes) constitute the preferred natural habitat for the CFPO in the Sonoran Desert (Monson and Phillips 1981, Flesch 2003, 2007; Flesch and Steidl 2000, 2002, 2006). Conceptually, vegetation along these washes may be considered stringers, or extensions, of Sinaloan Thornscrub extending northward from southern Sonora and northern Sinaloa through the Sonoran Desert into southern Arizona. The same or closely related plant species occur in both Sinaloan Thornscrub and in xeroriparian ecosystems in southern Arizona and northern Sonora (Brown 1982).

Fluctuations in CFPO Abundance in Arizona, at the Northern Extreme of its Range, May Be Attributed to Natural as Well as to Human Factors. The presence and abundance of a species at the periphery of its distribution are typically more variable and responsive to natural biological and climatic perturbations than populations in the interior of its range, leading to expansions and contractions of ranges over time. Thus, loss of CFPO populations at the northern extreme of the species' range would be expected from time to time. Also, the abundance of a species tends to decline from the center to the edge of that species' range (Brown 1984). Birds in particular are notable for distributional changes because of their high mobility, thus avian distributions contract and expand, often for no known reason (Phillips 1968). In Arizona, CFPO populations are currently most stable near the U.S.-Mexico border. This is not surprising in view of the fact that several plant species common in areas more densely occupied by CFPOs to the south reach their northern limits here (Table 1).

2.3 The CFPO Is Common throughout Most of Its Range but Has Never Been Common in Arizona

The Ferruginous Pygmy-Owl (FPO) is considered abundant and probably the most common owl in the American tropics (Terres 1980). In a recent Mexican study more specimens were found of this species than any other owl (Enriquez-Roca et al. 1993). Further, it is common for FPOs, and specifically CFPOs, to occur around villages, farms, and orchards as an edge species in the American tropics (Alden 1969, Meyer de Schauensee 1970). R.R. Johnson (senior author) has observed the FPO at the Jalisco-Colima border in coconut and banana plantations as well as around villages and orchards in the Peruvian Amazon. As described in greater detail later in this paper, recent records show that CFPOs in Arizona are following a similar pattern of gravitating to human-occupied areas with artificial water sources.

The CFPO Has Never Been Common in Arizona. Historical records, as detailed below, show that the CFPO has always been uncommon in southern and central Arizona, and specific populations have gone extinct. This may be due to natural (e.g., fluctuations in peripheral populations) as well as human (e.g., water storage and diversion projects) causes. The claim that the CFPO was never common in Arizona is based on 1) CFPO museum specimens, 2) CFPO egg sets, 3) published records, and 4) unpublished observations.

Fewer specimens of CFPO were collected than for other, truly common birds. Although some early ornithologists⁷ suggested that the CFPO was relatively common, the complete record of specimens and observations in Arizona does not support this contention. Only 41 CFPOs were collected in Arizona between the subspecies' discovery in 1872 and 1953 (after which the bird largely disappeared from the record for more than two decades), or an average of one bird every two years, with most specimens taken early in the period (Johnson et al. 2003; Table 2). This number of specimens is paltry considering that the late 1800s and early 1900s was a period when collectors were gathering thousands of birds in Arizona, often taking a dozen or more birds each of several species in a single collecting trip. For example, from April to June 1881, F. Stephens collected several hundred birds in the Tucson area (Brewster 1882–1883). For two weeks in May and June he collected dozens of species at Ft. Lowell, where the CFPO was originally recorded in Arizona, but he could find (and take) only one CFPO (Brewster 1882–1883). W.E.D. Scott collected 2,500 birds in central and southern Arizona from 1881 to 1886, and, although he mentioned the CFPO (Scott 1886), we could find no records of specimens of CFPO taken by him (Johnson et al. 2003).

Although the period of the late 1800s and early 1900s was one in which a large number of ornithologists and oologists actively collected nests and eggs, ⁸ fewer egg sets were collected in that period for CFPO than for other, truly common birds. Only 11 sets of CFPO eggs were collected in Arizona, or an average of 0.13 egg sets annually (Johnson et al. 2003, Table 2). The last eggs collected in Phoenix were in 1898, on the Gila River in 1908–1909 (Gilman 1909), and none were collected in Tucson and the Organ Pipe-Tohono O'odham regions. Egg collectors had collected thousands of eggs in the state and were still active after those dates, especially in southern Arizona. Collectors included Willard (1912), Dawson (1921), Lusk (1921), who collected the first set of CFPO eggs for Arizona at Cave Creek, north of Phoenix, in 1895 (Johnson et al. 2003), and Brandt (1951). In 1917, Dawson (1921) collected eggs from 42 species in the San Xavier bosque on the Santa Cruz River but found no CFPOs or their eggs.

Most publications for central and southern Arizona lowlands did not record the CFPO. Army surgeon Charles Bendire, who first discovered the species for the U.S., found it only along Rillito Creek (Coues 1872, Bendire 1892). The species was not mentioned by Breninger in a list of 86 species along the Gila River near Phoenix (1901), nor was it recorded in an extensive study along the Salt River near Phoenix (Swarth 1920), nor in the only early popular book on birds of the

⁷ "Ornithologist" is used here to describe anyone working with birds, whether professional, amateur, part-time, etc. that published papers, collected specimens, recorded observations, played leading roles in Christmas Bird Counts, etc.

In addition to their scientific value, egg collections were considered as art and people collected, bought, sold, and traded them the same way others did with paintings. Even some private collections numbered in the hundreds or thousands of sets (Strong 1919, 1923) before federal laws preventing this trade were enacted.

Phoenix area (Robinson 1930). Of the numerous ornithological papers published for the Phoenix area before 1950 only two mention the CFPO (Fisher 1893, Breninger 1898). During the late 1800s and first half of the 1900s, of approximately 40 extensive lists published for southern Arizona (Phillips et al. 1964, Anderson 1972) the CFPO is mentioned in only three papers (Brewster 1882–1883, Scott 1886, Howell 1916). Examples of the more than 35 papers that do not mention the CFPO include Swarth (1905) who lists 63 species, Willard (1912) who lists 67 species, Dawson (1921) who lists 103 species, and Monson (1942) who lists 47 species.

Observation records from university files, Audubon Society files, local park records, and Christmas Bird Counts show that the species was rarely recorded. From 1909 until 1971 (100 years after discovery of the CFPO in the U.S.) only three records of the CFPO appeared in Tucson Christmas Bird Counts despite participation in this full-day count by up to 70 participants or more. Christmas Bird Counts for Tucson began in 1909 (Brown 1910), the first for the state (Anderson 1972), but no CFPOs were recorded until 1932 (Anderson 1933).

Gaps in the CFPO Record Are Not Correlated to Ornithological Activity. Gaps during which no CFPOs were recorded occur in all regions. Gaps range from a few years to as long as 27 years for the Phoenix region, 19 years for the Tucson region, and 15 years for the Organ Pipe-Tohono O'odham region (Johnson et al. 2003). These gaps are in specimens, published reports, and observation records. For example, in the most intensively studies region, Tucson, there are no specimens, published reports, or observation records from 1896 to 1916 (Anderson 1972, Johnson et al. 2003). During those years at least 20 minor papers and four major papers were published, the latter each listing from 60 to more than 100 species for the Tucson region lowlands (Anderson 1972, Swarth 1914), reflecting significant ornithological activity in that area. This gap in CFPO records may reflect either a natural fluctuation in the CFPO population or population numbers so low that the owls went undetected.

In 1900–1950, an increasing number of ornithologists, including collectors, were conducting research in Arizona. During this period more than 1,000 person-days were spent on ornithological research in southern Arizona—perhaps 2,000 person-days or more—by both resident and visiting ornithologists. Although an occasional CFPO was recorded during this period, ornithologists published dozens of scientific papers on the region's avifauna in scientific journals and popular magazines without finding CFPOs, e.g., Vorhies et al. (1935), Monson (1942) (see also Phillips et al. 1964, Anderson 1972, Monson and Phillips 1981).

2.4 In Arizona, CFPOs Were Historically Found Most Often in Wet Riparian Habitats and Rarely in Upland Desert Habitats

Early Records Were Most Often from Wet Riparian Habitats. Historical records in Arizona were often sporadic and/or local, with records north of the Tucson region restricted to wet riparian ecosystems. An oddly spotty distribution is exemplified by a concentration of CFPO records along the Salt River near its confluence with the Verde River, but none for the Verde River, and several records for Rillito Creek, a tributary of the Santa Cruz River, but only one for the Santa Cruz River itself. All four watercourses originally had similar riparian woodland of cottonwood-willow and mesquite, ideal habitat for CFPOs. The following paragraphs summarize early records (or the absence of records) for these riparian areas.

New River north of Phoenix. New River is the northernmost site for both the species, Glaucidium brasilianum, and the subspecies, Glaucidium brasilianum cactorum (Proudfoot and Johnson 2000). The CFPO was called "quite common" at New River in 1892 (Fisher 1893:199). However, it had not been found there earlier by Mearns who was doing ornithological work in the same area along New River in 1884–85 (Mearns 1886, Bendire 1892). Further, R.R. Johnson (senior author) did not find it there from the 1960s to 1990s.

The Gila and Salt Rivers in the Phoenix region. Breninger (1898:128) reported the CFPO to be "of common occurrence" on the Salt and Gila Rivers in the Phoenix region. He collected 10 CFPOs and six sets of eggs between 1896 and 1899, and one other CFPO in 1905 at Phoenix. Most or all of Breninger's specimens were apparently from the Salt River (egg labels examined, R.R. Johnson [senior author]), which enters the Gila River near Phoenix. The species was not recorded at Papago Saguaro National Monument (now Papago Park, a City of Phoenix facility) on the north bank of the Salt River, upstream from Phoenix by Swarth (1920), nor was it mentioned in an early book on birds of the Phoenix area (Robinson 1930).

The Gila River upstream and downstream from Phoenix. The CFPO was called "fairly numerous" along the Gila River from the Gila River Indian Reservation, downstream to Agua Caliente (Gilman 1909:148). Yet, the CFPO was not on Breninger's list of 86 species from the Gila River Indian Reservation near Phoenix (Breninger 1901). It was not found on the Reservation by R.R. Johnson (senior author) in the 1950s and 1960s nor by Rea (1983) in the 1960s and later. Upstream, at Casa Grande, a single pygmy-owl was taken by Army surgeon E.A. Mearns in 1885 (Fisher 1893). Downstream from Gila Bend, at Agua Caliente, one CFPO was taken by Judson in 1896 (Johnson et al. 2003) and both pygmy-owls and eggs were found there by Gilman (1909) in 1908. However, again at Agua Caliente, no CFPOs were reported earlier by either Lt. W. H. Emory, who passed there in 1848 (Emory 1848), or by J.W. Audubon in 1849 (Audubon 1906).

Rillito Creek. The CFPO was first discovered in the United States in 1872 by C.E. Bendire along Rillito Creek, near Tucson (Coues 1872, Bendire 1892). Bendire later collected additional specimens in the same location. In all, nine of the twelve museum skins from the Tucson region, taken during the first 50 years (1872–1921) after the CFPO's discovery, are from Rillito Creek and a tributary, Sabino Canyon (Johnson and Carothers 2003a). The first CFPO sighted on a Christmas Bird Count was on December 24, 1932, in "Rillito Valley" (Anderson 1933). The next sighting was 11 years later, in Sabino Canyon (Foerster 1944). During the next 30 years only one more sighting of a CFPO was recorded on Tucson region Christmas Bird Counts.

The Santa Cruz River. Most early CFPO records in the Tucson region were from the Rillito Creek drainage, a tributary of the Santa Cruz River, yet only one CFPO record exists for the Santa Cruz River itself (Herbert Brown, in 1884 [Brown's field notes, Johnson et al. 2003]). This is problematic given that the Santa Cruz River is approximately the same size as Rillito Creek and, in the vicinity of Tucson, located at a similar elevation.

The Verde River. Although the Verde and Salt Rivers are approximately the same size near their confluence upstream from Phoenix, no CFPO records exist from the Verde River. Major Bendire,

the naturalist and the first recorder of the CFPO in Arizona, was stationed at Ft. McDowell on the Verde in the late 1800s, yet left no record of observing CFPO in the area. Mearns was stationed upstream of Ft. McDowell, at Camp Verde, during the late-1880s and wrote of explorations in areas that seem to be suitable CFPO habitat, yet he also failed to mention any observations of the CFPO in that region (Mearns 1886, Bendire 1892, Hume 1978, Fischer 2001). From the 1950s through the 1990s, R.R. Johnson (senior author) tried to find the CFPO along the Verde from its confluence with the Salt, upstream to Camp Verde. The only CFPOs found anywhere near the Verde were at Blue Point Cottonwoods, on the Salt River, the site for the last Phoenix region specimens (collected by Phillips in 1949 and 1951) and the last CFPO observations reported for the Phoenix region (Johnson and Simpson 1971, Millsap and Johnson 1988, Johnson et al. 2000, 2003).

In Arizona, No Early Arizona CFPO Records (1800s and Early 1900s) Exist from Upland Sonoran Desertscrub. Sources of historical avian records include numerous cross-country trips totaling thousands of miles traveled by some of the nation's leading ornithologists during the mid to late 1800s (see Appendix A). Included here are U.S.-Mexico boundary surveys (e.g., Emory 1857, 1859; Baird 1859) and follow-up expeditions along the Border (Mearns 1907). Also included are railroad surveys (e.g., Heermann 1859), military expeditions (e.g. Emory 1848; Bendire 1892, 1895), private ornithological trips (e.g. Audubon 1906, Aiken 1937), and other government exploratory expeditions (e.g., Henshaw 1875a, 1875b). None of these sources reported CFPOs in upland desert habitats.

A prime example is Bendire (1872, 1892), who, in spite of hundreds of miles of travel⁹ noted CFPOs only from riparian habitats. Captain Meams, in a 900-mile cross-country trip from Camp Verde to West Texas in 1885, recorded only one CFPO, and that was along the Gila River (Fisher 1893, Hume 1978).

2.5 More Recent Records Have Been from the Tohono O'odham Nation, Organ Pipe National Monument, U.S.-Mexico Border Lands, and Northwest Tucson.

CFPOs Now Are Known from Tohono O'odham, Organ Pipe National Monument, and U.S.-Mexico Border Lands, Although Historical Records Were Sparse. Evidence for the sparse occurrence of CFPOs near the U.S.-Mexico border in the nineteenth century is provided by details of a 1849–50 trip (on foot) by J.W. Audubon (son of John J. Audubon). He walked north through Sonora into southern Arizona, crossing the border west of Baboquivari Peak, and hiked across the Tohono O'odham Nation, through Sonoran Desertscrub to the Gila River (Audubon 1906, Fischer 2001). During this long journey he collected several important avian records (Cassin 1850) but none for the CFPO despite the fact that he traversed areas where CFPOs are now known to occur in numbers. From 1894 to 1949, only one specimen (on the Tohono O'odham Nation, originally the Papago Indian Reservation) and one sight record (at Organ Pipe National Monument) resulted from approximately 550 person-days of ornithological research. The CFPO record from the Nation during that period was collected in 1933 at Fresnal (Johnson et al. 2003), the site of some of the best riparian habitat in the area (Moore 1942). No CFPOs were

⁹ Bendire traveled north to at least Picacho Peak (Bendire 1892), east to at least Cienega Creek (Bendire 1872), and south to Tubac (Bendire 1895).

recorded at Organ Pipe until 1949 (Hensley 1951, 1954), 53 years after Mearns had spent several days on the Nation and at Organ Pipe National Monument (Mearns 1907).

CFPO populations at Organ Pipe, and presumably on the Tohono O'odham Nation, probably developed recently, during the mid 1900s (Appendix B). Recent work by Flesch and others has disclosed large numbers of CFPOs immediately adjacent to and south of the border between Arizona and Sonora (Flesch 2003, Flesch and Steidl 2000, 2002, 2006), much of which adjoins both the Tohono O'odham Nation and the Organ Pipe National Monument.

Due to prohibition on the release of information about CFPO surveys on the Tohono O'odham Nation, relatively little is known about the current status of the CFPO within Nation boundaries. However, several recent unpublished records of CFPO on the Nation exist (pers. comm., unnamed sources), as well as one recently published record for the area (Benesh and Rosenberg 1997). In addition to these sources, the occurrence of CFPOs on the Tohono O'odham Nation can be inferred from documented observations on surrounding lands. Several CFPOs have been found within Arizona immediately adjacent to the Nation (pers. comm. with various biologists) as well as immediately south of the U.S.-Mexico border, also immediately adjacent to the Nation (Flesch 2003, Flesch and Steidl 2000, 2002, 2006).

The recent occurrence of CFPOs at Organ Pipe National Monument is more definitively documented. Christmas Bird Counts there, begun in 1966 (Anderson 1972), have reported CFPOs on a more regular basis than anywhere else in the United States. This is at least partially responsible for the statement that the CFPO was absent in 1980 in Arizona "... except possibly in the Organ Pipe Cactus National Monument region" (Monson and Phillips 1981:72).

Many Recent Records of CFPO Occurrence in Arizona Have Shown an Association with Human Activity and Artificial Water Sources, Particularly in Northwest Tucson. The availability of artificial water sources in suburban and agricultural environments and subsequent increases in vegetation and food for prey may play an important role in the recent distribution of CFPO populations in Arizona. This is likely the case for northwest Tucson. development records of CFPO occurrence exist for what is now northwest Tucson, although ornithologists certainly visited the area. Bendire, for example, passed through or near this area on several occasions without apparently finding CFPOs (1872, 1892). B. Bristow (pers. comm. to R.R. Johnson) first found and photographed CFPOs in northwest Tucson in 1975, after urban development had spread into the area. During CFPO habitat studies conducted in 1997–1998 in northwest Tucson, all 21 sites studied for perch and nest sites "were within residential areas of varying density. Most houses were on a three- to five-acre parcels of land with 1-2 houses on the property" (Wilcox et al. 1999:17). Both exotic and native species were listed as woody vegetation used by CFPO in these residential areas. We suspect that the CFPOs are attracted to the artificial "riparian" habitats, i.e., increased moisture and vegetation, associated with mesic landscaping within the otherwise xeric upland habitat.

The association of recent CFPO records with human-made water sources is reflected in other locations in Arizona as well. For example, at Organ Pipe National Monument, between 1949 and 1983, 10 of 19 sightings recorded during every month (except January) were at the monument headquarters, the campground, or other places where water development had occurred

(Monument files). Another location, where the largest population of CFPOs in Arizona may exist (available data are meager due to tribal sovereignty issues), is the Tohono O'odham Nation, where water development for humans and livestock may provide the vegetation and prey needed by these owls.

2.6 Some Recently Collected Research Data Are Suspect and Monitoring Data Are Lacking

Recent Studies Showing Decreases in CFPO in Northern Sonora Used Unconventional Techniques and May Not Be Reliable. R.R. Johnson (senior author) and S.W. Carothers (junior author) are both experts in avian censusing and have conducted many censuses since 1969 (Carothers and Johnson 1970, 1971, 1972, 1973; Johnson 1971; Carothers et al. 1974; Aitchison et al. 1974,1975; Johnson et al. 1981; Johnson and Haight 1998). We find the unconventional census and survey methods used by Flesch (2003, 2007) and Flesch and Steidl (2000, 2002, 2006) troubling, both for the CFPO density and vegetation analysis.

Potential problems with placement of stations. The literature on estimating numbers of birds is large, but we could find no papers that support the methods used by Flesch in establishing census stations for counting CFPOs in Sonora (Flesch 2003, 2007; Flesch and Steidl 2000, 2002, 2006). Their results, which are the primary evidence cited by the petitioners for declining populations of CFPO, are based on unconventional methods and may not be reliable. Flesch initially established stations 350-400 m (approx. 400± yds) apart, but if an owl was encountered the next station was moved to 550-600 m (approx. 600+ yds). Any study we have seen sets up stations at a standardized length that is not changed during the study. The moving of a station adds an additional and unwarranted variable to standard census procedures. Further, this was done by Flesch only if an owl was detected the first time a census was run. In subsequent censuses, the same stations were used even if an owl was detected at a station where it was not found the first time. Thus, the method of lengthening the distance between stations to prevent double counting was never used after the first census for a given area. This is inconsistent and illogical. We checked two references that present standardized censusing techniques, one contained 24 papers (Ralph et al. 1997), the other with more than 100 papers on censusing birds (Ralph and Scott 1981), without finding any using Flesch's "floating stations" technique. Additionally, either distance, 350-400 m or 550-600 m, is insufficient, especially for work done before dawn and after dusk. With this short a distance between stations, a calling owl can follow the censuser from one station to another without being seen in the dark. Or, the owl may only fly part way from one station to another and be misconstrued as a new owl.

Lack of a standardized technique for measuring vegetation. Vegetation was analyzed by both "eye-balling" the major plant species and vegetative structure and using some measurements, e.g., distance between nests. Nowhere in Flesch (2003, 2007) and Flesch and Steidl (2000, 2002, 2006) can we find mention of a standardized technique for measuring vegetation, e.g., point quarter, which measures distances from a given point (e.g., a nest tree) to other vegetation in several directions, canopy cover, ground cover, or foliage height diversity to measure the vegetative structure at different heights from the ground (Carothers et al. 1974).

Lack of Consistent Monitoring Has Yielded Unreliable Data. A lack of consistent monitoring activity until the 1990s resulted in skewed, incomplete, or even inaccurate information. For example, Organ Pipe Cactus National Monument has a population of CFPOs known since 1949 (Hensley 1951, 1954), and, although numerous scientific ornithological studies have been conducted at the monument (see Appendix B), no concerted effort has been made to monitor the CFPO or other birds using a standardized protocol over any extended period. Between 1949 and 1983, when R.R. Johnson (senior author) started studying the species at the Monument, there were 19 sightings during every month except January (Organ Pipe Cactus National Monument files). However, these sightings were based largely on observers turning in records more or less haphazardly rather than on systematized or standardized techniques or recordkeeping. Patterns in the data may reflect years when monument staff were personally interested in birds rather than the presence or absence of the birds (Johnson and Haight 1984, 1985). Christmas Bird Counts, reported earlier in Audubon Field Notes and later in American Birds, were started as early as 1965 and CFPOs were sometimes observed. However, over the years different areas were included in the counts, thus not providing a long-time record for any given area.

Another example of a long-known population that was not monitored on any consistent or scientific basis until the 1990s was the northwest Tucson population. Even though this population was known as early as 1975 (Bud Bristow pers. comm. to R.R. Johnson) it was not mentioned by Monson and Phillips (1981). Part of the reason for this was an attempt to keep the location a secret (Gale Monson pers. comm. to R.R. Johnson). Little is known about the status of this population until systematic studies were begun by the Arizona Department of Game and Fish in the mid-1990s (Abbate et al. 1996, 1999, 2000). By 2006 the population had decreased to a single bird (pers. comm. Arizona Game and Fish Department personnel).

3.0 USE OF AN INVALID SCIENTIFIC NAME FOR THE CACTUS FERRUGINOUS OWL

The petitioners uses an unofficial name for the CFPO, Glaucidium ridgwayi cactorum, instead of the accepted name, Glaucidium brasilianum cactorum, thus disregarding the scientifically accepted North American and international protocols for classifying and naming birds.

The most recent official name for the Ferruginous Pygmy-Owl in North America, as well as in Central and South America, is *Glaucidium brasilianum* not *Glaucidium ridgwayi* (AOU 1998). In fact, *Glaucidium ridgwayi* is not recognized by any North American or world-wide checklist of which we are aware (Sibley and Monroe 1990, Monroe and Sibley 1997). Official names for birds of North America are determined by the American Ornithologists' Union (AOU) through periodic checklists containing standardized common and scientific names. The accuracy of these names is determined by the Committee on Classification and Nomenclature, composed of experts in this field, appointed by AOU officers. In addition to ongoing reviews of literature from a wide variety of sources, these committee members also do research themselves and apply the rules of the International Code of Zoological Nomenclature, which governs scientific names for animals throughout the world (see Mayr 1969 for discussion and text of the Code). The reason that avian common names are more often capitalized than names of other vertebrates is because of this standardization of common names by the AOU.

The last checklist of subspecies for North America north of Mexico published by AOU was in 1957. The following is the AOU range given for Glaucidium brasilianum cactorum: "Southcentral Arizona (Phoenix and Tucson, west to Agua Caliente), western and northwestern Sonora (Sonoyta) and lower Rio Grande Valley, Texas (Hidalgo County, Brownsville), south to Michoacan, Nuevo Leon, and Tamaulipas" (AOU 1957:282). Checklists published since then have listed species in North and Central America without subspecific designations (AOU 1983, 1998). The range given in the most recent checklist (AOU 1998) is the same as shown by Proudfoot and Johnson (2000). Supplements to update changes since the last official checklist are published by AOU at intervals, usually July of each year, or every second year. No supplements since the 1998 checklist have changed the official name of the Ferruginous Pygmy-Owl (AOU 2000, 2002, 2003, 2004, 2005, 2006). The idea for changing the name for the North American Ferruginous Pygmy-Owl to Glaucidium ridgwayi came from Konig et al. (1999) and was referenced by Proudfoot and Slack (2001) and Proudfoot et al. (2006). Even though these references suggest this new name based on mitochondrial DNA evidence, the name has no official standing, either on an international or North American basis, and the scientific community at large has not agreed to the suggested change.

The following demonstrates the rigorous peer review through which a newly proposed name must go. A new subspecies of the Ferruginous Pygmy-Owl, *Glaucidium brasilianum intermedium*, was proposed for the CFPO on the Pacific coast from Nayarit south to southern Nayarit by A.R. Phillips (1966). This proposed new subspecies of Ferruginous Pygmy-Owl was not accepted by most ornithologists (Proudfoot and Johnson 2000) even though Phillips was one of North America's leading ornithologists and avian taxonomists (Phillips 1986, 1991, Phillips et al. 1964). Phillips eventually named more than 150 new species and subspecies of birds (Dickerman and Parkes 1997).

4.0 NOTABLE INACCURACIES AND MISCONCEPTIONS IN THE LITERATURE

Few birds in Arizona are less understood than the CFPO. Its status and distribution have been misinterpreted and/or misstated, even by experts. This is partially because populations throughout Arizona have been in a state of flux during the past century. Allan R. Phillips, Arizona's foremost ornithologist, omitted the species in an important paper regarding changes in avian distribution in the Southwest (Phillips 1968), in part because of the complexity of the CFPO's changing distribution and abundance and contradictory claims about the bird's abundance (pers. comm. to R.R. Johnson). Following are four examples of problematic information about the species.

- (1) The following outdated statement in *The Birds of Arizona*: "...at present this bird [the CFPO] is most frequently seen at the mouth of the Verde River and eastward" (Phillips et al. 1964:52). This statement was based on two specimens taken by Phillips in 1949 and 1951 at Blue Point Cottonwoods, on the Salt River near the mouth of the Verde (Johnson and Simpson 1971). After 1951, the species was not recorded from that site for 20 more years (Johnson and Simpson 1971; Johnson and Haight 1985, 1998; Johnson et al. 2000).
- (2) The following incorrect statement in *The Raptors of Arizona*: "[The CFPO] is not common in adjacent Mexico within about 100 miles of the border" (Monson 1998:161).

Recent studies have shown it to be relatively common and widespread immediately adjacent to the Mexican border southward below Organ Pipe and the Tohono O'odham Nation (Flesch and Steidl 2000, 2002, 2006).

- (3) The following incorrect statement in Annotated Checklist of the Birds of Arizona: "[In 1980 the CFPO is] absent except possibly in the Organ Pipe Cactus National Monument region" (Monson and Phillips 1981:72). Although a population was known at Organ Pipe (Johnson and Haight 1984, Groschupf et al. 1988), an actively breeding population of CFPOs had been earlier discovered in northwest Tucson in 1975, six years prior to the publication of that statement (Bud Bristow pers. comm. to R.R. Johnson).
- (4) The following misinterpretation in Annotated Checklist of the Birds of Arizona: "[The CFPO] has declined considerably in numbers (and range?) since about 1950" (Monson and Phillips 1981:72). The 1920s is a more realistic date, for by then there was a drastic decline in specimens (Table 2), published records, and observations of the CFPO in Arizona. The species had been extirpated from the mid and lower Gila by 1910. After 1905, no eggs were collected in the Phoenix region and only three more specimens were taken. After 1922, in the Tucson region, only three more specimens and no eggs were taken, in spite of an increasing number of ornithologists looking for birds and eggs in Arizona (Johnson et al. 2003).

Table 1. Plants reaching their northernmost range in extreme southern Arizona¹ (Benson and Darrow 1954, Kearney and Peebles 1960, Vines 1960, Shreve and Wiggins 1964, Rickett 1966, Hastings et al. 1972, Bowers 1980, Benson and Darrow 1981, Benson 1982, Brown 1982, Turner et al. 1995, Martin et al. 1998, Van Devender et al. 2000).

Common Name	Scientific Name	Distribution in U.S.	Southernmost Distribution ^{1,2}
Palo zorrillo	Atamisquea emarginata	Organ Pipe, at Quitobaquito and Aguajita.	TS and TDF
Garabatillo	Mimosa laxiflora	Organ Pipe and the Nation ³	TS and TDF
Pringle's acalypha	Acalypha pringleii	Organ Pipe and the Nation	SD
Limber bush	Jatropha cuneata	Organ Pipe and Cabeza Prieta Wildlife Refuge	TS and TDF
Limber bush	Jatropha cinerea	Organ Pipe, Quitobaquito Hills and Senita Basin	TS and& TDF
Night blooming cereus	Peniocereus striatus	Organ Pipe and the Nation	SD
Senita cactus	Lophocereus schottii	Organ Pipe and Cabeza Prieta Wildlife Refuge	TS and TDF
Hinds' nightshade	Solanum hindsianum	Organ Pipe	SD

¹ From Sonoran Desertscrub of extreme southern Arizona, southward through the Sonoran Desert of Sonora, Mexico and, when designated, into Thomscrub and Tropical Deciduous Forest of southern Sonora and Sinoloa.

² Key: TS=Thomscrub, TDF=tropical Deciduous Forest, SD=Sonoran Desertscrub

³ Tohono O'odham Nation (formerly Papago Indian reservation).

Table 2. Cactus Ferruginous Pygmy-Owl skins and egg sets collected in Arizona by 30-year increments (modified from Johnson et al. 2004).

Period	Tucson Region		Gila R. Region		Phoenix Region		TOTALS	
	Skins	Egg Sets	Skins	Egg Sets	Skins	Egg Sets	Skins	Egg Sets
1872-1901	7		2		13	9	22	9
1902–31	9 ¹		3 ²	2	1		13	2
1932–61	3				3		6	0
TOTAL	19	0	5	2	17	9	41	11

¹ Includes Moore's Fresnal specimen from Reservation (Johnson et al. 2003).

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² Two skins and one live bird (Gilman 1909).

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APPENDIX A

REFERENCES TO COLLECTING TRIPS DURING THE 1800S AND EARLY 1900S

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APPENDIX B

REFERENCES TO EARLY RESEARCH AT ORGAN PIPE CACTUS NATIONAL MONUMENT AND TOHONO O'ODHAM NATION (EARLIER, PAPAGO INDIAN RESERVATION)

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A SCIENTIFIC ANALYSIS OF THE MARCH 15, 2007, PETITION TO LIST THE CACTUS FERRUGINOUS PYGMY-OWL AS A THREATENED OR ENDANGERED SPECIES

R. Roy Johnson, Ph.D. and Steven W. Carothers, Ph.D. 2

May 2007

1.0 INTRODUCTION

This document presents a scientific analysis of a petition submitted by the Center for Biological Diversity and Defenders of Wildlife to the U.S. Fish and Wildlife Service (Service) on March 15, 2007, to list one of the following entities of Cactus Ferruginous Pygmy-Owl: 1) the Arizona distinct population segment (DPS) of the Cactus Ferruginous Pygmy-Owl; 2) the Sonoran Desert DPS of the Cactus Ferruginous Pygmy-Owl; or 3) the western subspecies of Cactus Ferruginous Pygmy-Owl as a threatened or endangered species under the Endangered Species Act (ESA), 16 USC §§ 1531–1544. The petitioners also seek emergency protection for any of the three petitioned pygmy-owl entities and designation of critical habitat concurrent with any listing decision.

The Arizona DPS of the Cactus Ferruginous Pygmy-Owl (Glaucidium brasilianum cactorum; CFPO)—inappropriately referred to in the petition as Glaucidium ridgwayi cactorum—was listed as endangered on March 10, 1997 (62 FR 10730), with critical habitat designated on July 12, 1999 (64 FR 37419). As a result of a U.S. Court of Appeals for the Ninth Circuit opinion issued on August 19, 2003 (National Association of Home Builders v. Norton, 340 F. 3d 835, 852 (9th Cir. 2003)), the Service reassessed the application of the DPS significance. They found that, based on the available information and science, the Arizona DPS of the CFPO does not qualify as an entity that can be listed under the ESA. Accordingly, on April 14, 2006, the Service removed the Arizona population of pygmy-owls from the endangered species list and rescinded the critical habitat designation (71 FR 19452). It is the opinion of the authors of this report that no new scientific information has become available since the delisting in 2006 to contradict the Service's actions. Further, the attempt to list what the petitioners consider a distinct population segment within a portion of the population in Sonora violates taxonomic norms and is not supported by credible scientific study.

In their March 2007 petition to have the CFPO relisted, the petitioners claim that the Service failed to consider whether the Arizona population is significant to the taxon because it represents the only population of the CFPO in the continental U.S., or to consider whether another entity should be protected, including the population occupying both Arizona and Sonora, Mexico (the Sonoran Desert Population). They argue that the Sonoran Desert Population qualifies as a distinct population because it occurs in a unique ecological setting, its loss would result in a significant gap in the range of the species, and it is markedly different in its genetic

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characteristics. The petitioners also claim that the Service failed to consider protection for the western subspecies of the CFPO, which they believe is threatened or endangered in a significant portion of its range.

The petitioners argue that emergency listing is justified because the species in question "is threatened with imminent extinction in the U.S.," and designation of critical habitat is needed, in part, because the former critical habitat designation provided essential guidance in identifying development project mitigation standards under the Pima County government's Sonoran Desert Conservation Plan and Multiple Species Conservation Plan.

The analysis presented in this document focuses on the weaknesses the petitioners' arguments for listing their so-called "Sonoran Desert DPS" of the CFPO as threatened or endangered under the ESA. The authors previously addressed the problems associated with listing the other populations identified by the petitioners (the "Arizona population" and the "western population") as threatened or endangered distinct population segments in the following reports, previously submitted to the Service:

- Johnson, R.R., and S.W. Carothers. 2003a. A history of the occurrence and distribution of the Cactus Ferruginous Pygmy-Owl (*Glaucidium brasilianum cactorum*) in southern and central Arizona: A scientific analysis of a species at the edge of its range. June 13, 2003. Prepared by Johnson and Haight Environmental Consultants, Tucson, AZ, and SWCA Environmental Consultants, Flagstaff, AZ, for Fennemore Craig Tucson AZ.
- Johnson, R.R., and S.W. Carothers. 2003b. A review: Designation of critical habitat for the Arizona distinct population segment of the Cactus Ferruginous Pygmy-Owl (Glaucidium brasilianum cactorum), Proposed Rule, United States Fish and Wildlife Service. (Fed. Reg. 67 [229]: 71032-71064; Nov. 27, 2002). With Comments on Cactus Ferruginous Pygmy-Owl Draft Recovery Plan United States Fish and Wildlife Service (January 2003). July 2003. Prepared by Johnson and Haight Environmental Consultants, Tucson, AZ, and SWCA Environmental Consultants, Flagstaff, AZ, for Fennemore Craig, Tucson, AZ.
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- Johnson, R.R., and S.W. Carothers. 2005b. Comments on the proposed rule to remove the Arizona distinct population segment of the Cactus Ferruginous Pygmy-Owl from the federal list of endangered and threatened wildlife. September 5, 2005. Prepared by Johnson and Haight Environmental Consultants, Tucson, AZ, and SWCA Environmental Consultants, Flagstaff, AZ, for Fennemore Craig, Phoenix, AZ.

In the interest of brevity, all the points raised in the above reports are not repeated here, and the reader is encouraged to review these reports to obtain a more complete understanding of the CFPO's status.

In addition to analyzing the validity of the so-called "Sonoran Desert DPS" and addressing other weaknesses in the petitioners' case for listing a discrete population segment of the CFPO as threatened or endangered, in this paper we explain why the petitioners' use of the name *Glaucidium ridgwayi* for the CFPO is inappropriate, and we summarize inaccuracies and misconceptions in the scientific literature that have fueled misunderstandings about the status of the CFPO in Arizona and Mexico.

2.0 WEAKNESSES IN PETITION ARGUMENTS

The petitioners argue that a population segment (either the pygmy-owls in Arizona, the pygmy-owls inhabiting the Sonora Desert in both Arizona and Sonora, Mexico, or the pygmy-owls that constitute the genetically distinct western population) of the CFPO should be listed because:

1. It occurs in a unique ecological setting, its loss would result in a significant gap in the range of the species, and it is markedly different in its genetic characteristics.

<u>Rebuttal</u>: As noted in the introduction to this paper, we have addressed problems with listing the Arizona population and the western population of CFPOs as distinct population segments in previous papers. In this document, we focus on reasons why the petitioners' "Sonoran Desert Population" fails to meet the discreteness test for eligibility for listing as a DPS. Among other reasons, the proposed DPS does not occupy a unique ecological setting, nor is it specific to the Sonoran Desert but ranges across at least three biomes. There is no break in the distribution of the CFPO in the western Mexican lowlands to justify DPS status based on geography, nor is there a sharp break in faunas or floras of the ecosystems these owls inhabit, nor are there significant genetic differences within the western population.

2. The CFPO is subject to present or threatened destruction, modification, or curtailment of its habitat or range.

In support of this contention, the petitioners claim that the CFPO was historically common in riparian woodlands across much of southern Arizona, but the 85% loss of the state's riparian areas has caused the pygmy-owl to largely disappear from the state's few remaining riverside forests.

<u>Rebuttal</u>: We agree that the loss of a very large percentage of riparian habitat (mainly to water storage and diversion projects prior to 1920) has resulted in the near disappearance of the pygmy-owl from its traditional habitats in Arizona. We disagree, however, that the CFPO was ever common in the state. While a few early observers did indicate that the bird was "of common occurrence" (Breninger 1989:128), "fairly numerous" (Gilman

1909:148), and "quite common" (Fisher 1893:199) in specific wet riparian habitats, the actual record of collections and reported observations of Arizona's avifauna, which we summarize in this paper, strongly suggest that then CFPO was in fact uncommon in the state as far back as historical records have been kept.

The petitioners go on to claim that, "today, the species is found in small numbers primarily in upland habitats, including Sonoran Desertscrub and semidesert grasslands, where it is threatened by urban development in both Arizona and Sonora, where human populations are rapidly expanding."

Rebuttal: We agree that the CFPO now occurs in small numbers in mainly upland habitats in the northern periphery of its range; however, we contend that the pygmy-owl did not make an inexplicable (from a biological point of view) change in its habitat preference from wet riparian to dry upland desert. We argue that recent records of CFPO occurrence in Arizona suggest that this subspecies has largely substituted artificial (human-made) water sources in upland desert surroundings for its traditional natural riparian habitats. We show in this paper that the largest known population of CFPOs in half a century appeared in suburban northwest Tucson in the 1970s, where landscaping and other human water uses support the vegetation and associated prey species needed by this subspecies. It is telling that there is no evidence that CFPOs occurred in that area when it was undeveloped, dry upland desert. The subsequent disappearance of those pygmy-owls from Tucson is widely used to support claims that urban development is a threat to the CFPO, and that upland desert areas need to be preserved to conserve this owl. Nothing is said in these claims that human development, like that in northwest Tucson, may actually attract CFPOs to areas they would not otherwise inhabit.

We provide evidence in this paper that, in the northern periphery of the CFPO's range, that is, in Arizona, this pygmy-owl did not traditionally occupy upland desert habitats and, for the most part, still does not. It is therefore unjustifiable to designate large tracts of such desert as critical habitat (in order to limit development in those tracts) when the CFPO does not, nor ever has, occupied such habitat in this part of its range. Restricting development in upland desert in Arizona may help to conserve some species, but it is unlikely that the CFPO is among them.

3. The CFPO is subject to other natural or manmade factors affecting the continued existence of the species.

<u>Rebuttal</u>: In this section of the petition, the petitioners claim that, in Sonora, the CFPO population is declining. This conclusion is largely based on the work of Flesch and Steidl (2006). In this paper we point out that the methods used by these researchers are unconventional and cast doubt on the validity of their results.

2.1 The "Sonoran Desert Population" Does Not Meet the Discreteness Test for Listing as a Distinct Population Segment

The so-called "Sonoran Desert Population" of the CFPO, advocated by the petitioners as a distinct population segment (DPS), is an artificial, invalid grouping. To be listed as a DPS, a population must be discrete, which means 1) the population is markedly separated from other populations of the same taxon; or 2) the population is delimited "by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist" (61 FR 4722). The population of CFPO that occupies the Sonoran Desert in Arizona and Sonora, Mexico, meets neither of these criteria for discreteness. Obviously, the "Sonoran Desert Population" of CFPO extends across the U.S.-Mexico boundary and does not satisfy the second criterion. This "population" also does not satisfy the first criterion because there is no break in the distribution of the CFPO in the western Mexican lowlands and no sharp break in faunas or floras of the ecosystems it inhabits. It is therefore illogical and invalid to propose an artificial break and to differentiate between a "Sonoran Desert Population" of the CFPO from others to the south.

The "Sonoran Desert Population" Represents an Artificial Break in a Continuous Distribution. The CFPO shows a continuous distribution in western Mexico, between the Sierra Madre Occidental to the east and Pacific coast to the west, and from Arizona, south through Sonora and Sinoloa, continuing southward through Central America. Thus, the petitioners' "Sonoran Desert Population" of the CFPO constitutes an artificial break in this continuous distribution. Range maps and distribution descriptions for Mexican birds, owls, etc., show a continuous distribution for the CFPO from northern Mexico into Central America (Friedmann et al. 1950, Blake 1953, Grossman and Hamlet 1964, Davis 1972, Peterson and Chalif 1973, Burton 1984, Ginn 1984, Edwards 1989, Howell and Webb 1995, American Ornithologists' Union [AOU] 1998, Proudfoot and Johnson 2000).

The "Sonoran Desert Population" Is Not Restricted to the Sonoran Desert or Particularly Representative of Sonoran Desert Fauna. Claiming that there is a "Sonoran Desert Population" of CFPO that meets the criteria for listing as a DPS fails to acknowledge that the CFPO is not restricted to the Sonoran Desert but occurs in a wide variety of vegetation types (Brown 1982, 1994). There is nothing "discrete" about those pygmy-owls owls that occur in the Sonora Desert. In fact, the CFPO inhabits at least three biomes (major natural communities, each characterized by a distinctive vegetation type). From north to south, these biomes are (1) Sonoran Desertscrub, (2) Sinaloan Thornscrub, and (3) Tropical Deciduous Forest. The definitive work on birds of Sonora, Mexico (Russell and Monson 1998) shows the CFPO occurring throughout that state and notes it "is resident throughout most of the desertscrub, thornscrub, and tropical deciduous forest" (Russell and Monson 1998:141).

The CFPOs That Occur in the Sonoran Desert Are Not Genetically Distinct from CFPOs in Other Biomes. Recent mitochondrial DNA work found that the genetics of CFPOs in Sonoran Desertscrub, Sinaloan Thornscrub, and Tropical Deciduous Forest are similar, precluding the designation of a "Sonoran Desert Population" based on genetic analysis (Proudfoot and Slack

2001, Proudfoot et al. 2006). "Populations from Arizona, Sonora, and Sinaloa are genetically distinct [from]...populations occurring in Texas and other regions of Mexico" (Proudfoot et al. 2006:1).

The type specimen for *Glaucidium brasilianum cactorum*, the CFPO, was taken between Guaymas and Empalme, in the southern half of Sonora (van Rossem 1937, AOU 1957). This is approximately 240 mi south of the boundary between Sonora and Arizona but only 125 mi north of Tropical Deciduous Forest = Sinaloan Deciduous Forest of Brown and Lowe (1980). In addition, less than 10 mi east of Guaymas one encounters Sinaloan Thorncrub. More sophisticated genetic analysis would probably show that the type CFPO is more closely related to populations in Tropical Deciduous Forest and Sinaloan Thorncrub than the so-called "Sonoran Desert Population." This all negates the idea of a "Sonoran Desert Population" of the CFPO as a distinct population segment.

The CFPO Is Part of a Larger Faunal Community That Extends across Multiple Biomes in Arizona and Mexico. The continuous distribution of the CFPO, from southern Arizona and northern Sonora, Mexico, southward throughout the lowlands of western Mexico, is shared by a large number of other animal species, especially birds. There is no sharp break in this fauna between the Sonoran Desert and contiguous areas in the American tropics to the south, e.g., Sinaloan Thornscrub and Sinaloan Deciduous Forest. A high percentage of the animals that occur in the Sonoran Desert also occur in these adjacent, more southerly biomes.

Other species that have a named subspecies whose distribution extends from Arizona, south through the west Mexican lowlands and through numerous vegetation types include the Gray Hawk (Asturina nitidus plagiata), Inca Dove (Columbina inca), Northern Beardless-Tyrannulet (Camptostoma imberbe ridgwayi), Tropical Kingbird (Tyrannus melancholicus satrapa), to name a few (Friedmann et al. 1950, AOU 1957, 1998; Miller et al. 1957, Howell and Webb 1995, Stouffer and Chesser 1998, Tenney 2000, Bibles et al. 2002).

Of the 57 species of higher order, common and abundant breeding birds listed for Tropical Deciduous Forest (Russell 2000), 46 song birds (Passeriformes) and 4 woodpeckers (Piciformes) also occur in Arizona. Thus 87.7% of avian species commonly breeding in Tropical Deciduous Forest of southern Sonora and northern Sinaloa also breed in Arizona (Phillips et al. 1964, Monson and Phillips 1981, Corman and Wise-Cervais 2005). Of the ten species of birds (including the CFPO) listed for Sinaloan Thornscrub by Brown (1982, 1994), only two do not occur in the Sonoran Desert. The other eight species occur northward to at least southern Arizona.

Plant Species Overlap Ecosystems Inhabited by the CFPO. There is no sharp break in the flora (plant species) of the lowlands of western Mexico between southern Arizona and Sinaloa, Mexico. Vegetation changes gradually from north to south, from the Sonoran Desert in Arizona, through the Sonoran Desert in Sonora, Mexico, into the Sinaloan Thornscrub and, finally, into the Tropical Deciduous Forest of southern Sonora and Sinaloa.

Plant species that are directly important or that are components of ecosystems important to the CFPO, occurring in southern Arizona and northern Sonora, also occur in Sinaloan Thornscrub (Bowers 1980, Brown 1982, 1994; Tibbitts and Dickson 1999). These include ironwood (*Olney tesota*), velvet mesquite (*Prosopis juliflora*), acacias (*Acacia spp.*), blue palo verde (*Cercidium floridum*), desert hackberry (*Celtis pallida*), graythorn (*Ziziphus obtusifolia*), and numerous others. Several of these, and closely related plant species, also occur farther south, in Tropical Deciduous Forest (Martin et al. 1998, Van Devender et al. 2000).

Of the 90 plant species listed for the Sinaloan Thornscrub by Brown (1982, 1994) only 2 (2.2%) are restricted to Sinaloan Thornscrub. The other 88 species occur to some degree in the Sonoran Desert to the north. Of these 88 species, 36 (40%) extend northward into Arizona. In addition, many of these same species, occurring in the Sonoran Desert, continue south through Sinaloan Thornscrub and into Tropical Deciduous Forest (Martin et al. 1998, Van Devender et al. 2000).

Shreve, the leading expert on North American Deserts, especially the Sonoran Desert, designated 31 "Characteristic Species" for the Sonoran Desert (excluding those restricted to Baja California). Of these 31 species, 23 (74.2%) occur in both the Sonoran Desert and the Sinaloan Thornscrub of southern Sonora, Mexico (Shreve 1951, Shreve and Wiggins 1964). These species are so prevalent that many are commonly seen from the road as one drives southward through western Mexico (Mason and Mason 1987). Also, 21 (67.7%) of these 31 species occur from the Sonoran Desert of southern Arizona, south through the Sonoran Desert of northern Mexico and into the Sinaloan Thornscrub. Additionally, 15 (48.4%) of these Characteristic Species of the Sonoran Desert occur in the second biome south of the Sonoran Desert, Tropical Deciduous Forest (Martin et al. 1998, Van Devender et al. 2000).

The Sinaloan Thornscrub of Brown and Lowe (1980) and Brown et al. (1979, 1980) was originally designated as the Foothills of Sonora as part of the Sonoran Desert by Shreve (1951). The continuation of so many plant species from Sonoran Desertscrub, southward into what is now know as Sinaloan Thornscrub, are among the factors that led Shreve to his decision.

2.2 Low and Declining CFPO Population Numbers in Arizona Are More Likely a Function of Its Position at the Extreme Edges of Its Range and Large-scale Historical Water Development Than of Urban and Suburban Development

Most concern over the low and apparently declining numbers of CFPO recorded in Arizona recently has focused on the impact of the rapidly growing urban and suburban development in southern Arizona. However, historical records of the CFPO's distribution, habitat preferences, and changing population numbers suggest that forces other than urban and suburban development have had more profound effects on this subspecies. The key concept underlying all these forces is the fact that Arizona lies at the extreme northern and western edge of the CFPO's range. A record of the CFPO at New River in south-central Arizona (Fisher 1893) represents the northernmost known occurrence of this subspecies and for the species as a whole (Proudfoot and Johnson 2000), while the Agua Caliente records (Gilman 1909, Johnson et al. 2003) and Cabeza Prieta Tanks record are the westernmost records for the species (Monson 1955). Habitats to the

north and west of these locations clearly have not been suitable for the CFPO as long as ornithological records have been kept, and the relatively sparse records within Arizona suggest that even occupied habitat was and is marginal and localized. Arizona's position at the periphery of the CFPO's range has several implications, including the bird's historical and recent habitat preferences in Arizona; fluctuations in CFPO abundance in Arizona over time; and lower population numbers in Arizona relative to abundances in the more southerly portions of the CFPO's range.

The Preferred Habitat of the CFPO in the Northern and Western Limits of its Range Is Riparian and Xeroriparian Environments. Historically, the preferred habitat of the CFPO at the northern and western limits of its range has been wet riparian ecosystems (see the review of historical records later in this paper). Xeroriparian ecosystems, which includes dry wash vegetation, constitute a secondary habitat. No early CFPO records exist from upland Sonoran Desertscrub in Arizona, suggesting this habitat is not suitable for CFPOs at the northern extreme of its range (discussed at greater length later in this paper).

The deciduous Riparian Gallery Forests (cottonwood-willow [*Populus-Salix*] and others) along perennial and intermittent streams of southern Arizona structurally resemble the Tropical Deciduous Forest of more southerly reaches of the CFPO's range. It is not surprising, then, that all northern peripheral records (north of Tucson) were from near water. Record locations include New River (Fisher 1893), Cave Creek (Johnson et al. 2003), and Salt River (Breninger 1898, Johnson et al. 2003) from the Phoenix region; the upper Gila near Ft. Thomas (Aiken 1937); the middle Gila on the Gila River Indian Reservation (Gilman 1909, Rea 1983); the lower Gila at Agua Caliente (Gilman 1909, Johnson et al. 2003); and Gale Monson's (1955) westernmost record at Cabeza Prieta Tank.

When Arizona experienced a major loss of wet riparian habitat in the early 1900s due to water projects, e.g., large reclamation dams and diversions for mining, livestock, municipalities, and other human uses, CFPO populations precipitously declined (Johnson et al. 2000, Johnson et al 2003). Currently, xeroriparian ecosystems (primarily along washes) constitute the preferred natural habitat for the CFPO in the Sonoran Desert (Monson and Phillips 1981, Flesch 2003, 2007; Flesch and Steidl 2000, 2002, 2006). Conceptually, vegetation along these washes may be considered stringers, or extensions, of Sinaloan Thornscrub extending northward from southern Sonora and northern Sinaloa through the Sonoran Desert into southern Arizona. The same or closely related plant species occur in both Sinaloan Thornscrub and in xeroriparian ecosystems in southern Arizona and northern Sonora (Brown 1982).

Fluctuations in CFPO Abundance in Arizona, at the Northern Extreme of its Range, May Be Attributed to Natural as Well as to Human Factors. The presence and abundance of a species at the periphery of its distribution are typically more variable and responsive to natural biological and climatic perturbations than populations in the interior of its range, leading to expansions and contractions of ranges over time. Thus, loss of CFPO populations at the northern extreme of the species' range would be expected from time to time. Also, the abundance of a species tends to decline from the center to the edge of that species' range (Brown 1984). Birds in

particular are notable for distributional changes because of their high mobility, thus avian distributions contract and expand, often for no known reason (Phillips 1968). In Arizona, CFPO populations are currently most stable near the U.S.-Mexico border. This is not surprising in view of the fact that several plant species common in areas more densely occupied by CFPOs to the south reach their northern limits here (Table 1).

2.3 The CFPO Is Common throughout Most of Its Range but Has Never Been Common in Arizona

The Ferruginous Pygmy-Owl (FPO) is considered abundant and probably the most common owl in the American tropics (Terres 1980). In a recent Mexican study more specimens were found of this species than any other owl (Enriquez-Roca et al. 1993). Further, it is common for FPOs, and specifically CFPOs, to occur around villages, farms, and orchards as an edge species in the American tropics (Alden 1969, Meyer de Schauensee 1970). R.R. Johnson (senior author) has observed the FPO at the Jalisco-Colima border in coconut and banana plantations as well as around villages and orchards in the Peruvian Amazon. As described in greater detail later in this paper, recent records show that CFPOs in Arizona are following a similar pattern of gravitating to human-occupied areas with artificial water sources.

The CFPO Has Never Been Common in Arizona. Historical records, as detailed below, show that the CFPO has always been uncommon in southern and central Arizona, and specific populations have gone extinct. This may be due to natural (e.g., fluctuations in peripheral populations) as well as human (e.g., water storage and diversion projects) causes. The claim that the CFPO was never common in Arizona is based on 1) CFPO museum specimens, 2) CFPO egg sets, 3) published records, and 4) unpublished observations.

Fewer specimens of CFPO were collected than for other, truly common birds. Although some early ornithologists³ suggested that the CFPO was relatively common, the complete record of specimens and observations in Arizona does not support this contention. Only 41 CFPOs were collected in Arizona between the subspecies' discovery in 1872 and 1953 (after which the bird largely disappeared from the record for more than two decades), or an average of one bird every two years, with most specimens taken early in the period (Johnson et al. 2003; Table 2). This number of specimens is paltry considering that the late 1800s and early 1900s was a period when collectors were gathering thousands of birds in Arizona, often taking a dozen or more birds each of several species in a single collecting trip. For example, from April to June 1881, F. Stephens collected several hundred birds in the Tucson area (Brewster 1882–1883). For two weeks in May and June he collected dozens of species at Ft. Lowell, where the CFPO was originally recorded in Arizona, but he could find (and take) only one CFPO (Brewster 1882–1883). W.E.D. Scott collected 2,500 birds in central and southern Arizona from 1881 to 1886, and, although he

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³ "Ornithologist" is used here to describe anyone working with birds, whether professional, amateur, part-time, etc. that published papers, collected specimens, recorded observations, played leading roles in Christmas Bird Counts, etc.

mentioned the CFPO (Scott 1886), we could find no records of specimens of CFPO taken by him (Johnson et al. 2003).

Although the period of the late 1800s and early 1900s was one in which a large number of ornithologists and oologists actively collected nests and eggs, fewer egg sets were collected in that period for CFPO than for other, truly common birds. Only 11 sets of CFPO eggs were collected in Arizona, or an average of 0.13 egg sets annually (Johnson et al. 2003, Table 2). The last eggs collected in Phoenix were in 1898, on the Gila River in 1908–1909 (Gilman 1909), and none were collected in Tucson and the Organ Pipe-Tohono O'odham regions. Egg collectors had collected thousands of eggs in the state and were still active after those dates, especially in southern Arizona. Collectors included Willard (1912), Dawson (1921), Lusk (1921), who collected the first set of CFPO eggs for Arizona at Cave Creek, north of Phoenix, in 1895 (Johnson et al. 2003), and Brandt (1951). In 1917, Dawson (1921) collected eggs from 42 species in the San Xavier bosque on the Santa Cruz River but found no CFPOs or their eggs.

Most publications for central and southern Arizona lowlands did not record the CFPO. Army surgeon Charles Bendire, who first discovered the species for the U.S., found it only along Rillito Creek (Coues 1872, Bendire 1892). The species was not mentioned by Breninger in a list of 86 species along the Gila River near Phoenix (1901), nor was it recorded in an extensive study along the Salt River near Phoenix (Swarth 1920), nor in the only early popular book on birds of the Phoenix area (Robinson 1930). Of the numerous ornithological papers published for the Phoenix area before 1950 only two mention the CFPO (Fisher 1893, Breninger 1898). During the late 1800s and first half of the 1900s, of approximately 40 extensive lists published for southern Arizona (Phillips et al. 1964, Anderson 1972) the CFPO is mentioned in only three papers (Brewster 1882–1883, Scott 1886, Howell 1916). Examples of the more than 35 papers that do not mention the CFPO include Swarth (1905) who lists 63 species, Willard (1912) who lists 67 species, Dawson (1921) who lists 103 species, and Monson (1942) who lists 47 species.

Observation records from university files, Audubon Society files, local park records, and Christmas Bird Counts show that the species was rarely recorded. From 1909 until 1971 (100 years after discovery of the CFPO in the U.S.) only three records of the CFPO appeared in Tucson Christmas Bird Counts despite participation in this full-day count by up to 70 participants or more. Christmas Bird Counts for Tucson began in 1909 (Brown 1910), the first for the state (Anderson 1972), but no CFPOs were recorded until 1932 (Anderson 1933).

Gaps in the CFPO Record Are Not Correlated to Ornithological Activity. Gaps during which no CFPOs were recorded occur in all regions. Gaps range from a few years to as long as 27 years for the Phoenix region, 19 years for the Tucson region, and 15 years for the Organ Pipe-Tohono O'odham region (Johnson et al. 2003). These gaps are in specimens, published reports, and observation records. For example, in the most intensively studies region, Tucson, there are

⁴ In addition to their scientific value, egg collections were considered as art and people collected, bought, sold, and traded them the same way others did with paintings. Even some private collections numbered in the hundreds or thousands of sets (Strong 1919, 1923) before federal laws preventing this trade were enacted.

no specimens, published reports, or observation records from 1896 to 1916 (Anderson 1972, Johnson et al. 2003). During those years at least 20 minor papers and four major papers were published, the latter each listing from 60 to more than 100 species for the Tucson region lowlands (Anderson 1972, Swarth 1914), reflecting significant ornithological activity in that area. This gap in CFPO records may reflect either a natural fluctuation in the CFPO population or population numbers so low that the owls went undetected.

In 1900–1950, an increasing number of ornithologists, including collectors, were conducting research in Arizona. During this period more than 1,000 person-days were spent on ornithological research in southern Arizona—perhaps 2,000 person-days or more—by both resident and visiting ornithologists. Although an occasional CFPO was recorded during this period, ornithologists published dozens of scientific papers on the region's avifauna in scientific journals and popular magazines without finding CFPOs, e.g., Vorhies et al. (1935), Monson (1942) (see also Phillips et al. 1964, Anderson 1972, Monson and Phillips 1981).

2.4 In Arizona, CFPOs Were Historically Found Most Often in Wet Riparian Habitats and Rarely in Upland Desert Habitats

Early Records Were Most Often from Wet Riparian Habitats. Historical records in Arizona were often sporadic and/or local, with records north of the Tucson region restricted to wet riparian ecosystems. An oddly spotty distribution is exemplified by a concentration of CFPO records along the Salt River near its confluence with the Verde River, but none for the Verde River, and several records for Rillito Creek, a tributary of the Santa Cruz River, but only one for the Santa Cruz River itself. All four watercourses originally had similar riparian woodland of cottonwood-willow and mesquite, ideal habitat for CFPOs. The following paragraphs summarize early records (or the absence of records) for these riparian areas.

New River north of Phoenix. New River is the northernmost site for both the species, Glaucidium brasilianum, and the subspecies, Glaucidium brasilianum cactorum (Proudfoot and Johnson 2000). The CFPO was called "quite common" at New River in 1892 (Fisher 1893:199). However, it had not been found there earlier by Mearns who was doing ornithological work in the same area along New River in 1884–85 (Mearns 1886, Bendire 1892). Further, R.R. Johnson (senior author) did not find it there from the 1960s to 1990s.

The Gila and Salt Rivers in the Phoenix region. Breninger (1898:128) reported the CFPO to be "of common occurrence" on the Salt and Gila Rivers in the Phoenix region. He collected 10 CFPOs and six sets of eggs between 1896 and 1899, and one other CFPO in 1905 at Phoenix. Most or all of Breninger's specimens were apparently from the Salt River (egg labels examined, R.R. Johnson [senior author]), which enters the Gila River near Phoenix. The species was not recorded at Papago Saguaro National Monument (now Papago Park, a City of Phoenix facility) on the north bank of the Salt River, upstream from Phoenix by Swarth (1920), nor was it mentioned in an early book on birds of the Phoenix area (Robinson 1930).

The Gila River upstream and downstream from Phoenix. The CFPO was called "fairly numerous" along the Gila River from the Gila River Indian Reservation, downstream to Agua Caliente (Gilman 1909:148). Yet, the CFPO was not on Breninger's list of 86 species from the Gila River Indian Reservation near Phoenix (Breninger 1901). It was not found on the Reservation by R.R. Johnson (senior author) in the 1950s and 1960s nor by Rea (1983) in the 1960s and later. Upstream, at Casa Grande, a single pygmy-owl was taken by Army surgeon E.A. Mearns in 1885 (Fisher 1893). Downstream from Gila Bend, at Agua Caliente, one CFPO was taken by Judson in 1896 (Johnson et al. 2003) and both pygmy-owls and eggs were found there by Gilman (1909) in 1908. However, again at Agua Caliente, no CFPOs were reported earlier by either Lt. W. H. Emory, who passed there in 1848 (Emory 1848), or by J.W. Audubon in 1849 (Audubon 1906).

Rillito Creek. The CFPO was first discovered in the United States in 1872 by C.E. Bendire along Rillito Creek, near Tucson (Coues 1872, Bendire 1892). Bendire later collected additional specimens in the same location. In all, nine of the twelve museum skins from the Tucson region, taken during the first 50 years (1872–1921) after the CFPO's discovery, are from Rillito Creek and a tributary, Sabino Canyon (Johnson and Carothers 2003a). The first CFPO sighted on a Christmas Bird Count was on December 24, 1932, in "Rillito Valley" (Anderson 1933). The next sighting was 11 years later, in Sabino Canyon (Foerster 1944). During the next 30 years only one more sighting of a CFPO was recorded on Tucson region Christmas Bird Counts.

The Santa Cruz River. Most early CFPO records in the Tucson region were from the Rillito Creek drainage, a tributary of the Santa Cruz River, yet only one CFPO record exists for the Santa Cruz River itself (Herbert Brown, in 1884 [Brown's field notes, Johnson et al. 2003]). This is problematic given that the Santa Cruz River is approximately the same size as Rillito Creek and, in the vicinity of Tucson, located at a similar elevation.

The Verde River. Although the Verde and Salt Rivers are approximately the same size near their confluence upstream from Phoenix, no CFPO records exist from the Verde River. Major Bendire, the naturalist and the first recorder of the CFPO in Arizona, was stationed at Ft. McDowell on the Verde in the late 1800s, yet left no record of observing CFPO in the area. Mearns was stationed upstream of Ft. McDowell, at Camp Verde, during the late-1880s and wrote of explorations in areas that seem to be suitable CFPO habitat, yet he also failed to mention any observations of the CFPO in that region (Mearns 1886, Bendire 1892, Hume 1978, Fischer 2001). From the 1950s through the 1990s, R.R. Johnson (senior author) tried to find the CFPO along the Verde from its confluence with the Salt, upstream to Camp Verde. The only CFPOs found anywhere near the Verde were at Blue Point Cottonwoods, on the Salt River, the site for the last Phoenix region specimens (collected by Phillips in 1949 and 1951) and the last CFPO observations reported for the Phoenix region (Johnson and Simpson 1971, Millsap and Johnson 1988, Johnson et al. 2000, 2003).

In Arizona, No Early Arizona CFPO Records (1800s and Early 1900s) Exist from Upland Sonoran Desertscrub. Sources of historical avian records include numerous cross-country trips totaling thousands of miles traveled by some of the nation's leading ornithologists during the mid

to late 1800s (see Appendix A). Included here are U.S.-Mexico boundary surveys (e.g., Emory 1857, 1859; Baird 1859) and follow-up expeditions along the Border (Mearns 1907). Also included are railroad surveys (e.g., Heermann 1859), military expeditions (e.g. Emory 1848; Bendire 1892, 1895), private ornithological trips (e.g. Audubon 1906, Aiken 1937), and other government exploratory expeditions (e.g., Henshaw 1875a, 1875b). None of these sources reported CFPOs in upland desert habitats.

A prime example is Bendire (1872, 1892), who, in spite of hundreds of miles of travel⁵ noted CFPOs only from riparian habitats. Captain Mearns, in a 900-mile cross-country trip from Camp Verde to West Texas in 1885, recorded only one CFPO, and that was along the Gila River (Fisher 1893, Hume 1978).

2.5 More Recent Records Have Been from the Tohono O'odham Nation, Organ Pipe National Monument, U.S.-Mexico Border Lands, and Northwest Tucson.

CFPOs Now Are Known from Tohono O'odham, Organ Pipe National Monument, and U.S.-Mexico Border Lands, Although Historical Records Were Sparse. Evidence for the sparse occurrence of CFPOs near the U.S.-Mexico border in the nineteenth century is provided by details of a 1849–50 trip (on foot) by J.W. Audubon (son of John J. Audubon). He walked north through Sonora into southern Arizona, crossing the border west of Baboquivari Peak, and hiked across the Tohono O'odham Nation, through Sonoran Desertscrub to the Gila River (Audubon 1906, Fischer 2001). During this long journey he collected several important avian records (Cassin 1850) but none for the CFPO despite the fact that he traversed areas where CFPOs are now known to occur in numbers. From 1894 to 1949, only one specimen (on the Tohono O'odham Nation, originally the Papago Indian Reservation) and one sight record (at Organ Pipe National Monument) resulted from approximately 550 person-days of ornithological research. The CFPO record from the Nation during that period was collected in 1933 at Fresnal (Johnson et al. 2003), the site of some of the best riparian habitat in the area (Moore 1942). No CFPOs were recorded at Organ Pipe until 1949 (Hensley 1951, 1954), 53 years after Mearns had spent several days on the Nation and at Organ Pipe National Monument (Mearns 1907).

CFPO populations at Organ Pipe, and presumably on the Tohono O'odham Nation, probably developed recently, during the mid 1900s (Appendix B). Recent work by Flesch and others has disclosed large numbers of CFPOs immediately adjacent to and south of the border between Arizona and Sonora (Flesch 2003, Flesch and Steidl 2000, 2002, 2006), much of which adjoins both the Tohono O'odham Nation and the Organ Pipe National Monument.

Due to prohibition on the release of information about CFPO surveys on the Tohono O'odham Nation, relatively little is known about the current status of the CFPO within Nation boundaries. However, several recent unpublished records of CFPO on the Nation exist (pers. comm., unnamed sources), as well as one recently published record for the area (Benesh and Rosenberg

⁵ Bendire traveled north to at least Picacho Peak (Bendire 1892), east to at least Cienega Creek (Bendire 1872), and south to Tubac (Bendire 1895).

1997). In addition to these sources, the occurrence of CFPOs on the Tohono O'odham Nation can be inferred from documented observations on surrounding lands. Several CFPOs have been found within Arizona immediately adjacent to the Nation (pers. comm. with various biologists) as well as immediately south of the U.S.-Mexico border, also immediately adjacent to the Nation (Flesch 2003, Flesch and Steidl 2000, 2002, 2006).

The recent occurrence of CFPOs at Organ Pipe National Monument is more definitively documented. Christmas Bird Counts there, begun in 1966 (Anderson 1972), have reported CFPOs on a more regular basis than anywhere else in the United States. This is at least partially responsible for the statement that the CFPO was absent in 1980 in Arizona "...except possibly in the Organ Pipe Cactus National Monument region" (Monson and Phillips 1981:72).

Many Recent Records of CFPO Occurrence in Arizona Have Shown an Association with Human Activity and Artificial Water Sources, Particularly in Northwest Tucson. The availability of artificial water sources in suburban and agricultural environments and subsequent increases in vegetation and food for prey may play an important role in the recent distribution of CFPO populations in Arizona. This is likely the case for northwest Tucson. No predevelopment records of CFPO occurrence exist for what is now northwest Tucson, although ornithologists certainly visited the area. Bendire, for example, passed through or near this area on several occasions without apparently finding CFPOs (1872, 1892). B. Bristow (pers. comm. to R.R. Johnson) first found and photographed CFPOs in northwest Tucson in 1975, after urban development had spread into the area. During CFPO habitat studies conducted in 1997-1998 in northwest Tucson, all 21 sites studied for perch and nest sites "were within residential areas of varying density. Most houses were on a three- to five-acre parcels of land with 1-2 houses on the property" (Wilcox et al. 1999:17). Both exotic and native species were listed as woody vegetation used by CFPO in these residential areas. We suspect that the CFPOs are attracted to the artificial "riparian" habitats, i.e., increased moisture and vegetation, associated with mesic landscaping within the otherwise xeric upland habitat.

The association of recent CFPO records with human-made water sources is reflected in other locations in Arizona as well. For example, at Organ Pipe National Monument, between 1949 and 1983, 10 of 19 sightings recorded during every month (except January) were at the monument headquarters, the campground, or other places where water development had occurred (Monument files). Another location, where the largest population of CFPOs in Arizona may exist (available data are meager due to tribal sovereignty issues), is the Tohono O'odham Nation, where water development for humans and livestock may provide the vegetation and prey needed by these owls.

2.6 Some Recently Collected Research Data Are Suspect and Monitoring Data Are Lacking

Recent Studies Showing Decreases in CFPO in Northern Sonora Used Unconventional Techniques and May Not Be Reliable. R.R. Johnson (senior author) and S.W. Carothers (junior author) are both experts in avian censusing and have conducted many censuses since 1969

(Carothers and Johnson 1970, 1971, 1972, 1973; Johnson 1971; Carothers et al. 1974; Aitchison et al. 1974,1975; Johnson et al. 1981; Johnson and Haight 1998). We find the unconventional census and survey methods used by Flesch (2003, 2007) and Flesch and Steidl (2000, 2002, 2006) troubling, both for the CFPO density and vegetation analysis.

Potential problems with placement of stations. The literature on estimating numbers of birds is large, but we could find no papers that support the methods used by Flesch in establishing census stations for counting CFPOs in Sonora (Flesch 2003, 2007; Flesch and Steidl 2000, 2002, 2006). Their results, which are the primary evidence cited by the petitioners for declining populations of CFPO, are based on unconventional methods and may not be reliable. Flesch initially established stations 350-400 m (approx. 400± yds) apart, but if an owl was encountered the next station was moved to 550-600 m (approx. 600± yds). Any study we have seen sets up stations at a standardized length that is not changed during the study. The moving of a station adds an additional and unwarranted variable to standard census procedures. Further, this was done by Flesch only if an owl was detected the first time a census was run. In subsequent censuses, the same stations were used even if an owl was detected at a station where it was not found the first time. Thus, the method of lengthening the distance between stations to prevent double counting was never used after the first census for a given area. This is inconsistent and illogical. We checked two references that present standardized censusing techniques, one contained 24 papers (Ralph et al. 1997), the other with more than 100 papers on censusing birds (Ralph and Scott 1981), without finding any using Flesch's "floating stations" technique. Additionally, either distance, 350-400 m or 550-600 m, is insufficient, especially for work done before dawn and after dusk. With this short a distance between stations, a calling owl can follow the censuser from one station to another without being seen in the dark. Or, the owl may only fly part way from one station to another and be misconstrued as a new owl.

Lack of a standardized technique for measuring vegetation. Vegetation was analyzed by both "eye-balling" the major plant species and vegetative structure and using some measurements, e.g., distance between nests. Nowhere in Flesch (2003, 2007) and Flesch and Steidl (2000, 2002, 2006) can we find mention of a standardized technique for measuring vegetation, e.g., point quarter, which measures distances from a given point (e.g., a nest tree) to other vegetation in several directions, canopy cover, ground cover, or foliage height diversity to measure the vegetative structure at different heights from the ground (Carothers et al. 1974).

Lack of Consistent Monitoring Has Yielded Unreliable Data. A lack of consistent monitoring activity until the 1990s resulted in skewed, incomplete, or even inaccurate information. For example, Organ Pipe Cactus National Monument has a population of CFPOs known since 1949 (Hensley 1951, 1954), and, although numerous scientific ornithological studies have been conducted at the monument (see Appendix B), no concerted effort has been made to monitor the CFPO or other birds using a standardized protocol over any extended period. Between 1949 and 1983, when R.R. Johnson (senior author) started studying the species at the Monument, there were 19 sightings during every month except January (Organ Pipe Cactus National Monument files). However, these sightings were based largely on observers turning in records more or less haphazardly rather than on systematized or standardized techniques or

recordkeeping. Patterns in the data may reflect years when monument staff were personally interested in birds rather than the presence or absence of the birds (Johnson and Haight 1984, 1985). Christmas Bird Counts, reported earlier in *Audubon Field Notes* and later in *American Birds*, were started as early as 1965 and CFPOs were sometimes observed. However, over the years different areas were included in the counts, thus not providing a long-time record for any given area.

Another example of a long-known population that was not monitored on any consistent or scientific basis until the 1990s was the northwest Tucson population. Even though this population was known as early as 1975 (Bud Bristow pers. comm. to R.R. Johnson) it was not mentioned by Monson and Phillips (1981). Part of the reason for this was an attempt to keep the location a secret (Gale Monson pers. comm. to R.R. Johnson). Little is known about the status of this population until systematic studies were begun by the Arizona Department of Game and Fish in the mid-1990s (Abbate et al. 1996, 1999, 2000). By 2006 the population had decreased to a single bird (pers. comm. Arizona Game and Fish Department personnel).

3.0 USE OF AN INVALID SCIENTIFIC NAME FOR THE CACTUS FERRUGINOUS OWL

The petitioners uses an unofficial name for the CFPO, *Glaucidium ridgwayi cactorum*, instead of the accepted name, *Glaucidium brasilianum cactorum*, thus disregarding the scientifically accepted North American and international protocols for classifying and naming birds.

The most recent official name for the Ferruginous Pygmy-Owl in North America, as well as in Central and South America, is *Glaucidium brasilianum* not *Glaucidium ridgwayi* (AOU 1998). In fact, *Glaucidium ridgwayi* is not recognized by any North American or world-wide checklist of which we are aware (Sibley and Monroe 1990, Monroe and Sibley 1997). Official names for birds of North America are determined by the American Ornithologists' Union (AOU) through periodic checklists containing standardized common and scientific names. The accuracy of these names is determined by the Committee on Classification and Nomenclature, composed of experts in this field, appointed by AOU officers. In addition to ongoing reviews of literature from a wide variety of sources, these committee members also do research themselves and apply the rules of the International Code of Zoological Nomenclature, which governs scientific names for animals throughout the world (see Mayr 1969 for discussion and text of the Code). The reason that avian common names are more often capitalized than names of other vertebrates is because of this standardization of common names by the AOU.

The last checklist of *subspecies* for North America north of Mexico published by AOU was in 1957. The following is the AOU range given for *Glaucidium brasilianum cactorum*: "Southcentral Arizona (Phoenix and Tucson, west to Agua Caliente), western and northwestern Sonora (Sonoyta) and lower Rio Grande Valley, Texas (Hidalgo County, Brownsville), south to Michoacan, Nuevo Leon, and Tamaulipas" (AOU 1957:282). Checklists published since then have listed species in North and Central America without subspecific designations (AOU 1983, 1998). The range given in the most recent checklist (AOU 1998) is the same as shown by

Proudfoot and Johnson (2000). Supplements to update changes since the last official checklist are published by AOU at intervals, usually July of each year, or every second year. No supplements since the 1998 checklist have changed the official name of the Ferruginous Pygmy-Owl (AOU 2000, 2002, 2003, 2004, 2005, 2006). The idea for changing the name for the North American Ferruginous Pygmy-Owl to *Glaucidium ridgwayi* came from Konig et al. (1999) and was referenced by Proudfoot and Slack (2001) and Proudfoot et al. (2006). Even though these references suggest this new name based on mitochondrial DNA evidence, the name has no official standing, either on an international or North American basis, and the scientific community at large has not agreed to the suggested change.

The following demonstrates the rigorous peer review through which a newly proposed name must go. A new subspecies of the Ferruginous Pygmy-Owl, *Glaucidium brasilianum intermedium*, was proposed for the CFPO on the Pacific coast from Nayarit south to southern Nayarit by A.R. Phillips (1966). This proposed new subspecies of Ferruginous Pygmy-Owl was not accepted by most ornithologists (Proudfoot and Johnson 2000) even though Phillips was one of North America's leading ornithologists and avian taxonomists (Phillips 1986, 1991, Phillips et al. 1964). Phillips eventually named more than 150 new species and subspecies of birds (Dickerman and Parkes 1997).

4.0 NOTABLE INACCURACIES AND MISCONCEPTIONS IN THE LITERATURE

Few birds in Arizona are less understood than the CFPO. Its status and distribution have been misinterpreted and/or misstated, even by experts. This is partially because populations throughout Arizona have been in a state of flux during the past century. Allan R. Phillips, Arizona's foremost ornithologist, omitted the species in an important paper regarding changes in avian distribution in the Southwest (Phillips 1968), in part because of the complexity of the CFPO's changing distribution and abundance and contradictory claims about the bird's abundance (pers. comm. to R.R. Johnson). Following are four examples of problematic information about the species.

- (1) The following outdated statement in *The Birds of Arizona*: "...at present this bird [the CFPO] is most frequently seen at the mouth of the Verde River and eastward" (Phillips et al. 1964:52). This statement was based on two specimens taken by Phillips in 1949 and 1951 at Blue Point Cottonwoods, on the Salt River near the mouth of the Verde (Johnson and Simpson 1971). After 1951, the species was not recorded from that site for 20 more years (Johnson and Simpson 1971; Johnson and Haight 1985, 1998; Johnson et al. 2000).
- (2) The following incorrect statement in *The Raptors of Arizona*: "[The CFPO] is not common in adjacent Mexico within about 100 miles of the border" (Monson 1998:161). Recent studies have shown it to be relatively common and widespread immediately adjacent to the Mexican border southward below Organ Pipe and the Tohono O'odham Nation (Flesch and Steidl 2000, 2002, 2006).

- (3) The following incorrect statement in Annotated Checklist of the Birds of Arizona: "[In 1980 the CFPO is] absent except possibly in the Organ Pipe Cactus National Monument region" (Monson and Phillips 1981:72). Although a population was known at Organ Pipe (Johnson and Haight 1984, Groschupf et al. 1988), an actively breeding population of CFPOs had been earlier discovered in northwest Tucson in 1975, six years prior to the publication of that statement (Bud Bristow pers. comm. to R.R. Johnson).
- (4) The following misinterpretation in Annotated Checklist of the Birds of Arizona: "[The CFPO] has declined considerably in numbers (and range?) since about 1950" (Monson and Phillips 1981:72). The 1920s is a more realistic date, for by then there was a drastic decline in specimens (Table 2), published records, and observations of the CFPO in Arizona. The species had been extirpated from the mid and lower Gila by 1910. After 1905, no eggs were collected in the Phoenix region and only three more specimens were taken. After 1922, in the Tucson region, only three more specimens and no eggs were taken, in spite of an increasing number of ornithologists looking for birds and eggs in Arizona (Johnson et al. 2003).

Table 1. Plants reaching their northernmost range in extreme southern Arizona¹ (Benson and Darrow 1954, Kearney and Peebles 1960, Vines 1960, Shreve and Wiggins 1964, Rickett 1966, Hastings et al. 1972, Bowers 1980, Benson and Darrow 1981, Benson 1982, Brown 1982, Turner et al. 1995, Martin et al. 1998, Van Devender et al. 2000).

Common Name	Scientific Name	Distribution in U.S.	Southernmost Distribution ^{1,2}	
Palo zorrillo	Atamisquea emarginata	Organ Pipe, at Quitobaquito and Aguajita.	TS and TDF	
Garabatillo	Mimosa laxiflora	Organ Pipe and the Nation ³	TS and TDF	
Pringle's acalypha	Acalypha pringleii	Organ Pipe and the Nation	SD	
Limber bush	Jatropha cuneata	Organ Pipe and Cabeza Prieta Wildlife Refuge	TS and TDF	
Limber bush	Jatropha cinerea	Organ Pipe, Quitobaquito Hills and Senita Basin	TS and& TDF	
Night blooming cereus	Peniocereus striatus	Organ Pipe and the Nation	SD	
Senita cactus	Lophocereus schottii	Organ Pipe and Cabeza Prieta Wildlife Refuge	TS and TDF	
Hinds' nightshade	Solanum hindsianum	Organ Pipe	SD	

From Sonoran Desertscrub of extreme southern Arizona, southward through the Sonoran Desert of Sonora, Mexico and, when designated, into Thornscrub and Tropical Deciduous Forest of southern Sonora and Sinoloa.

² Key: TS=Thornscrub, TDF=tropical Deciduous Forest, SD=Sonoran Desertscrub

³ Tohono O'odham Nation (formerly Papago Indian reservation).

Table 2. Cactus Ferruginous Pygmy-Owl skins and egg sets collected in Arizona by 30-year increments (modified from Johnson et al. 2004).

Period	Tucson Region		Gila R. Region		Phoenix Region		TOTALS	
	Skins	Egg Sets	Skins	Egg Sets	Skins	Egg Sets	Skins	Egg Sets
1872-1901	7		2		13	9	22	9
1902–31	9		3 ²	2	1		13	2
1932–61	3				3		6	0
TOTAL	19	0	5	2	17	9	41	11

¹ Includes Moore's Fresnal specimen from Reservation (Johnson et al. 2003).
² Two skins and one live bird (Gilman 1909).

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APPENDIX A

REFERENCES TO COLLECTING TRIPS DURING THE 1800S AND EARLY 1900S

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APPENDIX B

REFERENCES TO EARLY RESEARCH AT ORGAN PIPE CACTUS NATIONAL MONUMENT AND TOHONO O'ODHAM NATION (EARLIER, PAPAGO INDIAN RESERVATION)

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COMMENTS ON THE 90-DAY FINDING ON A PETITION TO LIST THE CACTUS FERRUGINOUS PYGMY-OWL (GLAUCIDIUM RIDGEWAYI CACTORUM) AS THREATENED OR ENDANGERED WITH CRITICAL HABITAT (Fed Reg. 73 [106]: 31418-31424; June 2, 2008)

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WestLand Resources, Inc.

Sonora, Mexico

INTRODUCTION AND GENERAL COMMENTS

The purpose of this document is to provide our technical comments in response to the US Fish & Wildlife Service's (USFWS) 90-Day Finding on a Petition to list the Cactus Ferruginous Pygmy-Owl (Glaucidium ridgwayi cactorum)¹ as Threatened or Endangered With Critical Habitat (90-Day Finding) (Fed Reg. 73 [106]: 31418-31424; June 2, 2008).

On March 20, 2007, the USFWS received a petition (the Petition) from the Center for Biodiversity and Defenders of Wildlife (Petitioners) requesting that the cactus ferruginous pygmy owl (CFPO) be listed as a threatened or endangered species under the Endangered Species Act (ESA). The Petitioners also requested the designation of Critical Habitat concurrent with the listing. Upon receipt of a petition to list a species under the ESA, the USFWS conducts an evaluation to determine if the petition presents substantial information indicating that listing under the ESA may be warranted. This evaluation is commonly known as a "90-day finding." If a 90-day finding indicates that listing may be warranted, the USFWS initiates a 12-month status review of the species to determine whether or not to propose adding a species to the federal lists of endangered or threatened wildlife and plants.

On June 2, 2008, the USFWS published a positive 90-day finding on the petition. Upon review of the Petition, the USFWS has determined that "the petition presents substantial scientific or commercial information indicating that the listing of the pygmy-owl may be warranted."

In their 90-day finding, the USFWS outlined several specific subjects about which they are seeking additional information. Responses to selected subject areas (in bold text) are provided below.

INFORMATION REGARDING THE SPECIES' HISTORICAL AND CURRENT STATUS AND DISTRIBUTION IN ARIZONA

The CFPO is one of four subspecies of ferruginous pygmy-owl. It occurs from lowland central Arizona south through western Mexico, to the states of Colima and Michoacan, and from southern Texas south through the Mexican States of Tamaulipas and Nuevo Leon (Fed Reg 62 [46]: 10730; March 10, 1997).

In Arizona, the published historic range of the CFPO reportedly once encompassed large areas of the central and southern portions of the state and included portions of Gila, Pima, Pinal, Maricopa, Graham, Santa Cruz, Cochise, Greenlee, and Yuma Counties (Monson, 1998). Early accounts indicate that the CFPO primarily occupied riparian habitats containing continuous corridors of riparian woodlands characterized by towering cottonwoods, willows, and mesquites that once occurred along hundreds of miles of rivers and streams throughout south central Arizona (Johnson and Carothers, 2003a; Corman and

Note that the 90-day finding refers to Glaucidium ridgwayi cactorum (Fed Reg. 73 [106]: 31421; June 2, 2008). However, the recognized taxonomic classification for the ferruginous pygmy owl is Glaucidium brasilianum (AOU Checklist accessed September 19, 2008, Cartron et al., 2000). Therefore, the currently recognized scientific name for the subspecies commonly referred to as cactus ferruginous pygmy owl is Glaucidium brasilianum cactorum (see also the Integrated Taxonomic Information System www.itis.gov accessed on September 19, 2008).

Wise-Gervais, 2005). Much of these riparian gallery forests has been lost because of modification of the hydrologic regimes that supported them, lowering of the groundwater table, and the introduction of several species of salt cedar. Recent records of CFPO in Arizona are now limited to well-vegetated Sonoran desert-scrub, semi-desert grasslands, and associated densely vegetated xeroriparian washes, with many of these records being associated with the low-density housing development (typically less than one house per 3.3-acre lot, with varying levels of surface disturbance from lot development) in unincorporated portions of Pima County, north and west of Tucson (AZGFD, unpublished data).

Based on recently (1997-2002) known CFPO locations documented within the Arizona Game and Fish Department's (AZGFD) Heritage Data Management System (HDMS) Database, the recent range of the CFPO in Arizona encompassed approximately 4,432,600 acres (6,926 square miles) of Sonoran desertscrub and semi-desert grassland in Pima and Pinal Counties (Figure 1). This area included approximately 265,956 acres of land in northwest Tucson located north and east of Interstate Highway 10. As recently as 2000, as many as 11 CFPO occupied eight sites in this area. However, due to a number of factors, including ongoing drought and its potential adverse impacts on recruitment, predation, and demographic stochasticity, by 2004, the northwest Tucson CFPO subpopulation had declined to just three unpaired males (Scott Richardson, USFWS, personal communication to WestLand, 2004)². The fact that no females occupied this area, coupled with the significant obstacles to a female moving into the area from the south (e.g., Interstate 10), led the USFWS to determine that "it is speculative at best that a female would immigrate into the area within any of the male CFPOs' remaining lifetimes" and that the northwest Tucson CFPO subpopulation "...will not likely be rescued absent human intervention in the form of population augmentation" (USFWS, 2004). Unfortunately, this prediction proved accurate and the Petitioners reported that, by 2007, the northwest Tucson CFPO subpopulation had "declined to a single male owl" (the Petition, pp. 15)3. At the time of this writing, we are unaware of any extant CFPO in northwest Tucson.

Based on currently (2003–2007) known CFPO locations documented within the AZGFD HDMS Database, the current range of the CFPO in Arizona has been reduced to areas south and west of Interstate Highway 10 and encompasses approximately 3,995,638 acres (6,243 square miles) of Sonoran desert-scrub and semi-desert grassland in Pima County (Figure 2).

Much of the current range of CFPO in Arizona occurs on lands that are protected or are not considered at risk by the USFWS. The geographic center of the current range of CFPO in Arizona is the Tohono O'odham Nation (Corman and Wise-Gervais, 2005; Johnson and Carothers, 2003a, 2003b), which contains approximately 64 percent of the currently occupied range of CFPO in Arizona. CFPO on the

Although some have speculated that ongoing habitat loss was the primary factor in this decline (e.g., J. Neely speaking on behalf of the Defenders of Wildlife at the September 27, 2005 Planning and Zoning Commission Hearing), we are aware of no evidence that any CFPO died or CFPO territory was abandoned because of development activities in Northwest Tucson. Regardless of the causes, the northwest Tucson subpopulation is functionally extirpated.

³ This assertion is in error; the last male CFPO in Northwest Tucson was removed from the wild by AZGFD in 2006 for inclusion into their captive breeding program (Mike Ingraldi, AZGFD, personal communication to Mike Cross [Westland], 2008).

Tohono O'odham Nation are not considered to be at high risk by the USFWS (USFWS, 2002, 2003). The vast majority of the remainder of the current Arizona range of the CFPO is protected within the confines of Ironwood Forest National Monument (IFNM)⁴, Organ Pipe Cactus National Monument (OPCNM), Cabeza Prieta National Wildlife Refuge, and Buenos Aires National Wildlife Refuge (Figures 2 and 3). Lands within the Tohono O'odham Nation, national monuments, and wildlife refuges constitute approximately 82 percent of the current range of the CFPO in Arizona. The remainder of the current range of the CFPO is located within a mix of private property, State Trust Lands, lands managed by the Bureau of Land Management or the US Forest Service, the Pasqua Yaqui Reservation, and other publicly held lands. At the time of this writing, northwest Tucson is located outside the current range of the CFPO (Figures 2 and 3).

In recent years, the number of Pygmy-owls documented by the AZGFD totaled 31 in 2006, 16 in 2007, and 7 in 2008⁵. Of these, the number of active nesting pairs was 9, 5, and 2, respectively. Documented nesting was concentrated in the Altar Valley, with the exception of one nest in OPNM and one near the Roskruge Mountains west of Avra Valley⁶.

INFORMATION REGARDING THE STATUS, DISTRIBUTION, AND THREATS TO THE PYGMY-OWL IN MEXICO

Distribution

At the time of the listing Final Rule in 1997, the USFWS assumed that CFPOs were not present in northern Sonora (USFWS 1997). Since that time, however, hundreds of nesting locations have been found there, some within a kilometer of the Arizona border (Flesch, 2003).

"In northern Sonora, Mexico, immediately south of Arizona, pygmy-owls are locally common in desertscrub and grassland vegetation communities where woodlands occur near stands of saguaro cacti" (Flesch, 2003)."

Figure 4 depicts the locations of CFPO throughout Arizona, the Mexican State of Sonora, and a portion of the adjacent State of Sinaloa, Mexico. In addition to locations provided by Flesch, this map also depicts two areas identified by Robert Mesta, the Sonoran Joint Venture Coordinator for the USFWS. For the last 20 years or so, Robert Mesta has been conducting annual survey and monitoring of bald eagles nesting along the Rio Yaqui in eastern Sonora. Mesta reports that he regularly observes CFPO, both aurally and visually, along the Rio Yaqui from the confluence of the Rios Aros and Bavispe downstream to upper Novilla Reservoir near the town of Bacanora⁷. Mesta also reports encountering CFPO along the Rio Yaqui below Novilla Reservoir (Robert Mesta, USFWS, personal communication to Michael Cross,

⁴ IFNM is included here because it falls within the area delineated as the current range of the CFPO. Potential suitable habitat exists on the monument, but we are unaware of any records of CFPO occurrence on IFNM. However, to the best of our knowledge, no surveys have been conducted.

⁵ This low number may be heavily influenced by the lack of significant survey efforts throughout the Arizona range of the species.

⁶ Dennis Abbate, AZGFD, letter to Mike Cross (WestLand), July 17, 2008.

According to Mesta, the habitat and terrain of this area indicate that the pygmy-owls there are of the G.b.cactorum subspecies, not the closely related mountain pygmy-owls (G. gnoma).

September 22, 2005). The habitat occupied by these CFPO has been characterized by Mesta as Sinaloan thorn-scrub with elements of Sonoran desert-scrub. The vegetation present includes mesquites, chino trees, hecho cactus, and a few saguaros. The streamside riparian habitat is well-vegetated with willows and a few cottonwoods.

The presence of this previously undocumented population of CFPO along the upper Rio Yaqui suggests that CFPO may also occur along the Rio Bavispe northward past the town of Huasabas, possibly as far as Batepito. Brown (1994) indicates that the habitat in this area consists of Sinaloan thorn-scrub transitioning into Sonoran desert-scrub in the vicinity of Batepito, approximately 60 miles southeast of Douglas, Arizona. We are particularly intrigued about the possibility of CFPO occupying this disjunct area of Sonoran desert-scrub. Similar habitats at the same latitude to the west have been demonstrated by Flesch (2003) to support significant numbers of CFPO.

In the spring of 2008, the AZGFD initiated a research project to obtain and genetically analyze pygmy owl blood samples from across Sonora and northern Sinaloa. Groups of CFPO were trapped at different latitudes at 70-kilometer intervals between northern Sinaloa and northern Sonora. A total of 119 pygmyowls were captured and released after blood samples and other measurements were taken. The capture locations of these 119 CFPO are depicted on Figure 4.

Status

At the time of the listing Final Rule in 1997, the USFWS erroneously assumed that CFPOs were rare or absent in northern Sonora within 150 km of the border (USFWS 1997). Since that time hundreds of nesting locations have been found in northern Sonora, some within a kilometer of the Arizona border. As Flesch (2003) reported:

- "In northern Sonora, Mexico, immediately south of Arizona, pygmy-owls are locally common (emphasis supplied) in desertscrub and grassland vegetation communities where woodlands occur near stands of saguaro cacti."
- "Significant populations of pygmy-owls in adjacent Sonora may facilitate recovery of pygmy-owls in Arizona"
- "North-central Sonora harbors a large well-distributed population of pygmy-owls that contrast sharply with the widely dispersed, smaller populations in Arizona"
- "High abundance in northern Sonora offers more auspicious recovery prospects in portions of Arizona than was anticipated."

In 2005, Flesch and Steidl authored a report entitled *Population Trends and Implications for Monitoring Cactus Ferruginous Pygmy-Owls in Northern Mexico*. This paper was submitted to the Journal of Wildlife Management (JWM) and was ultimately published in JWM in 2006 (Flesch and Steidl, 2006). In

this report, the authors introduced the assertion that the CFPO was in a state of significant decline in northern Mexico. Based on this work and a series of subsequent papers authored by Flesch (the Flesch Reports), the Petitioners stated that:

"Pygmy Owls have also declined in Northern Sonora, Mexico where like Arizona, pygmy-owls primarily occur in Sonoran desertscrub and grassland with appropriate nest structures (Flesch and Steidl 2005, Flesch and Steidl 2006a and b, Flesch 2007). Flesch and Steidl (2006a) surveyed randomly selected transects, totaling just under 54 km, in northern Sonora, Mexico for pygmy owls between 2000–2004 and identified a decline in abundance that averaged -7% per year. Based on this analysis, Flesch and Steidl (2006a) determined that pygmy owls in northern Sonora declined by an estimated 37 percent from 2000–2004" ... # (the Petition, pp 17).

The Petition also stated that the reported declines continued in 2006 with Flesch (2007) concluding:

"In 2006, I surveyed all 54 km of transects that had been surveyed each year since 2000, determined occupancy in 102 territories, and monitored 47 nests within 110 km of Arizona. Abundance of pygmy-owls was similar to that observed in 2005 and has declined by an average of $4.4 \pm 1.9\%$ (\pm SE) per year (P = 0.0027) since 2000, a 26% decline over seven years. Further, territory occupancy declined $3.2 \pm 1.2\%$ per year (P = 0.0100) between 2002 and 2006 or 13% over five years, providing additional evidence that populations of pygmy-owls have recently declined in northern Sonora" ... # (the Petition, pp 17).

Based on these reported trends, the USFWS in their 90-day finding concluded that:

"We judge the information regarding a decline in pygmy owl numbers in northern Sonora (Flesch and Steidl, 2006) to be substantial and reliable."

We have reviewed the Flesch Reports and discussed their findings with a number of knowledgeable individuals. The following paragraphs summarize our impressions.

In order to access population trends, Flesch and Steidl (2006) monitored the relative abundance of CFPO along 18 transects totaling 53.7 km, all located within 75 km of the international border. The 2006 Flesch and Steidl study covered the five-year period from 2000 to 2004. During that period, the authors report that they "... detected a total of 188 males in 5 years; 55 in 2000, 32 in 2001, 36 in 2002, 37 in 2003, and 28 in 2004. ... Between 2000 and 2004, the population of pygmy-owls in Northern Sonora declined by 37%."

At first glance, the reported 37 percent decline over a four-year period suggests a serious threat to the persistence of the population. However, examination of their data indicates that the only period of

significant decline was 2000–2001, when reported numbers fell from 55 to 32⁸. The sampled population appears to have experienced a modest increase from 2001–2003. In 2004, the population declined from 37 to 28. Flesch and Steidl acknowledge that the reported decline was *heavily influenced by the year 2000*.

Our review of the methods described in Flesch and Steidl (2006) led us to question the validity of their data collection methods. Our primary concerns include issues related to the unconventional placement of call stations, the timing and duration of the surveys, and the lack of standardized technique in measuring vegetation⁹.

The unconventional placement of call stations. In describing the placement of call stations, Flesch and Steidl report that:

"We broadcast territorial calls to elicit responses from pygmy owls along a series of 5 to 8 stations spaced 350–400 m apart along drainage channels. If we detected an owl, we increased spacing of the next station to 550–600 m to reduce the probability of detecting the same bird more than once and used the same locations in subsequent years (emphasis supplied)."

We question this methodology for two reasons. First, it is our understanding that increasing the spacing between call stations from 350–400 meters to 550–600 meters is inadequate for ensuring that birds are not double counted. The AZGFD reports that, in Arizona, CFPO are occasionally detected between 600 and 1,000 meters away from the surveyor. In addition, it is common for territorial CFPO to move much closer to the surveyor in response to the broadcast. The AZGFD generally uses 800 meters as the minimum distance to advance along a transect once an owl is heard, but even this may not be enough under certain circumstances (AZGFD unpublished data). In addition, when CFPO were extant in northwest Tucson, the USFWS prohibited CFPO surveys within the entire section (1 square mile) of land known to be occupied by CFPO.

Secondly, after increasing the spacing between call stations where CFPO were detected, those stations were used for the duration of the study, regardless of subsequent years' survey results. Thus, if CFPOs were inadvertently double counted in 2000 because CFPO moved closer to the surveyor in response to broadcast calls at nearby adjacent stations, the same result would not be duplicated in subsequent years when spacing between call stations was increased.

We are puzzled by the fact that, although Flesch and Steidl (2005) report drastic declines of CFPO between 2000 and 2001, no mention is made of this purported decline in Flesch's Master's Thesis that was finalized on April 4, 2003, two years after the purported decline occurred. In fact, our review indicates that it was only after the 9th Circuit Court of Appeals ruled against the USFWS in National Ass'n of Home Builders v. Norton 340# F.3d 835 2008, decided August 19, 2003, that Flesch began to suggest that the Sonoran CFPO was at risk.

Westland Resources, Inc., has extensive experience with the CFPO in Arizona. WestLand biologists are familiar with the available literature on this species and have obtained scientific data and advice from other biologists. The authors of this document have personally supervised and conducted surveys for CFPO pursuant to USFWS protocol in many areas of Arizona over the last decade, including surveys in and around the Tucson metropolitan area and surveys on the Tohono O'odham Nation. These surveys have resulted in the detection of a number of CFPO. In addition, the two primary authors of this document were members of the implementation group of the CFPO Recovery Team when that team was active.

We have had the opportunity to review the comments of other reviewers who question this methodology. For example, Johnson and Carothers (2007) report that:

"We checked two references that present standardized censusing techniques, one contained 24 papers (Ralph et al. 1997), the other with more than 100 papers on censusing birds (Ralph and Scott 1981), without finding any using Flesch's 'floating stations' technique."

As stated above, Flesch and Steidl acknowledge that the reported decline was *heavily influenced by the year 2000*. We suspect that sampling error may have played a part in the reported decline observed between 2000 and 2001 and we suspect that some birds may have been double counted in year 2000. If the 2000 data are omitted from the analysis, we find that the sampled population appears to have experienced a modest increase from 2001–2003 and in 2004, the population declined from 37 to 28. The values from 2001 and 2004 were 32 and 28, respectively. These values are essentially the same. We believe that these numbers are consistent with normal population fluctuations.

Flesch has continued monitoring these transects and in Flesch (2007) reported the detections of 34 male CFPO in 2005 and 33 in 2006, for a 26.45 percent decline over all seven years. It is notable that the reported 2005 and 2006 numbers are commensurate with the 2001–2004 data, further supporting the possibility that the 2000 data were an aberration. In addition, with the addition of the 2005 and 2006 data, the reported decline decreases from 37 to 26.45 percent. If year 2000 is removed from the analysis, the reported detections for 2001 and 2006 are 32 and 33, respectively. These values are essentially equal.

The timing and duration of the surveys. In describing the timing of their surveys, Flesch and Steidl report that:

"We surveyed from one hr before to 3 hours after sunrise and between 17 April and 5 June during incubation and nesting stages of the breeding period."

In describing the duration of the surveys, Flesch and Steidl report that:

"We remained at stations for 8 minutes or until one minute after an owl was detected."

This methodology is inconsistent with the currently accepted CFPO survey protocol (USFWS 2000). For example, the USFWS protocol requires three surveys per season (January–June), one of which must occur between February 15 and April 15 in order to correspond with the season of peak calling activity. The responsiveness of CFPO to broadcast calls varies during the course of the breeding season. The document provides no data or discussion describing exactly when each of the annual surveys was conducted. For example, if surveys in year one (the year when most birds were reportedly detected) occurred in April, at the tail end of the peak calling cycle, while the others occurred later in the season when calling may be less frequent, then the basis for comparison is impaired. The protocol also stipulates that surveyors remain

at their call stations for a minimum of 15 minutes to ensure adequate response time. The AZGFD reports that there have been times when a pygmy-owl was not detected from a survey point until after the entire calling sequence was completed -10 to 15 minutes. Other owls have only been detected while surveyors were walking between points (AZGFD, unpublished data).

The lack of standardized technique in measuring vegetation. In describing how vegetation volume was estimated, Flesch and Steidl report that:

"We also estimated vegetation volume to the nearest 10% when values were between 20 and 80% and to the nearest 5% otherwise in 5 height strata: 0–1 m, 1–3 m, 3–6 m, 6–12 m, and >12 m above ground in both riparian and upland vegetation areas (Flesch 2003a). We considered vegetation within 400 m of survey stations for all measurements."

These qualitative measurements appear arbitrary and cannot be replicated. We are skeptical that someone can *visually* estimate to the nearest 5 percent, five strata classes within 400 meters of a point and expect to be accurate and consistent among vegetation types.

Because of the deficiencies we perceive in the methods employed above, we are skeptical of the conclusions presented in Flesch and Steidl's 2006 report.

In January 2008, Flesch authored an additional paper, *Population and Demographic Trends of Ferruginous Pygmy-owls in Northern Sonora Mexico 2000–2008*. In this paper, Flesch asserts that territorial occupancy of CFPO in northern Sonora has also declined to the point that:

"In 2008, estimates of relative abundance (mean \pm SE = 0.18 \pm 0.038 males/station) and territory occupancy (49.5 \pm 5.0%) were lower than during any previous year since monitoring began."

We have had the opportunity to review this paper. The same data-quality concerns outlined above also apply to this work. In addition, we offer the following comments related to territorial occupancy over time.

The CFPO is a relatively short-lived species (Mike Ingraldi, AZGFD, personal communication to Mike Cross [Westland], August 26, 2008). We are aware of no literature that suggests that an individual CFPO territory is occupied over long periods of time. The methods described by Flesch (2008) do not take into account that individual birds may die and/or move on. We would assume that, if one only monitored known territories from fixed locations, occupancy could be expected to drop as birds reached the end of their natural life spans. We believe that a better approach would be to monitor the number of territories across a geographical area over time. In spite of our reservations about his methods and conclusions, we find that Mr. Flesch's statement that "rainfall is driving regional population dynamics of pygmy-owls by influencing food availability" is plausible.

Several statements within this report indicate that the status of CFPO in northern Sonora may not be as precarious as contended. For example, Mr. Flesch stated that:

- "Occupancy near Sasabe¹⁰ has increased each of the last two years."
- "Data on reproductive performance suggest there are no systematic problems with reproduction of pygmy-owls in northern Sonora."

The AZGFD has initiated a research project to obtain and genetically analyze CFPO blood samples from across Sonora and northern Sinaloa. In the spring of 2008, AZGFD and their cooperators trapped groups of pygmy-owls at different latitudes at 70-kilometer intervals between northern Sinaloa and northern Sonora. This effort resulted in the capture and release of a total of 119 CFPO. In addition, numerous additional CFPO were detected during this effort11. These CFPO were readily found within suitable habitat throughout the project area in Mexico (i.e., habitat containing large cavity-bearing cactus, such as saguaro [Carnegiea gigantea] or hecho [Pachycereus pectin-arboriginum]). This suggests that the CFPO are still widespread in suitable habitats within Sonora. We believe that recent assertions that the CFPO population is experiencing a drastic decline in northern Sonora are premature and may be in error.

¹⁰ Sasabe, Sonora, is immediately adjacent to the U.S. border, and this population is most proximate to CFPO in Arizona.

¹¹ At some call stations, as many as five CFPO were detected simultaneously responding to broadcast territorial calls.

CONCLUSION

The CFPO occurs from lowland central Arizona south through western Mexico, to the states of Colima and Michoacan, and from southern Texas south through the Mexican states of Tamaulipas and Nuevo Leon (Fed Reg 62 [46]: 10730; March 10, 1997). As described above, the published historic range of the CFPO reportedly once encompassed large areas of central and southern Arizona and included portions of Gila, Pima, Pinal, Maricopa, Graham, Santa Cruz, Cochise, Greenlee, and Yuma Counties. Early accounts indicate that the CFPO primarily occupied riparian habitats containing continuous corridors of riparian woodlands. Much of these riparian gallery forests have been lost because of modification of the hydrologic regimes that supported them. Recent CFPO records in Arizona are now limited to wellvegetated Sonoran desert-scrub, semi-desert grasslands, and associated densely vegetated xeroriparian washes. Based on currently (2003-2007) documented CFPO locations, the current range of the CFPO in Arizona has been reduced to areas south and west of Interstate Highway 10 and encompasses approximately 3,995,638 acres (6,243 square miles) of Sonoran desert-scrub and semi-desert grassland in Pima County. The vast majority of the currently occupied CFPO habitat (82 percent) lies within areas protected as national monuments and wildlife refuges or other areas where CFPO habitat is not considered to be at risk by the USFWS (e.g., the Tohono O'odham Nation). In Sonora, Mexico, the CFPO remains widespread and reports indicating that the CFPO population is seriously declining in northern Sonora are, in this reviewer's opinion, premature and possibly overstated.

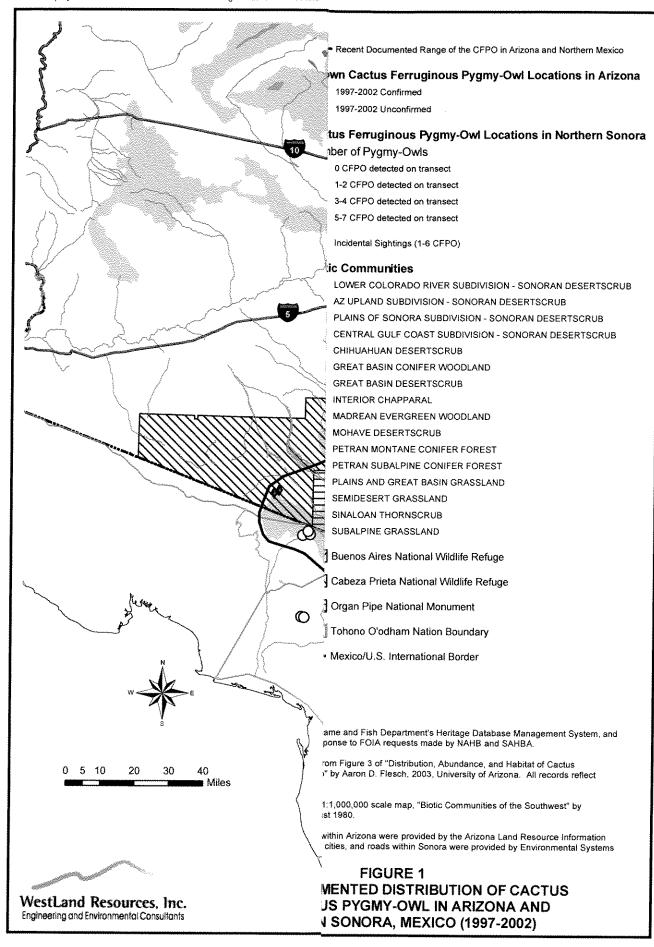
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FIGURES



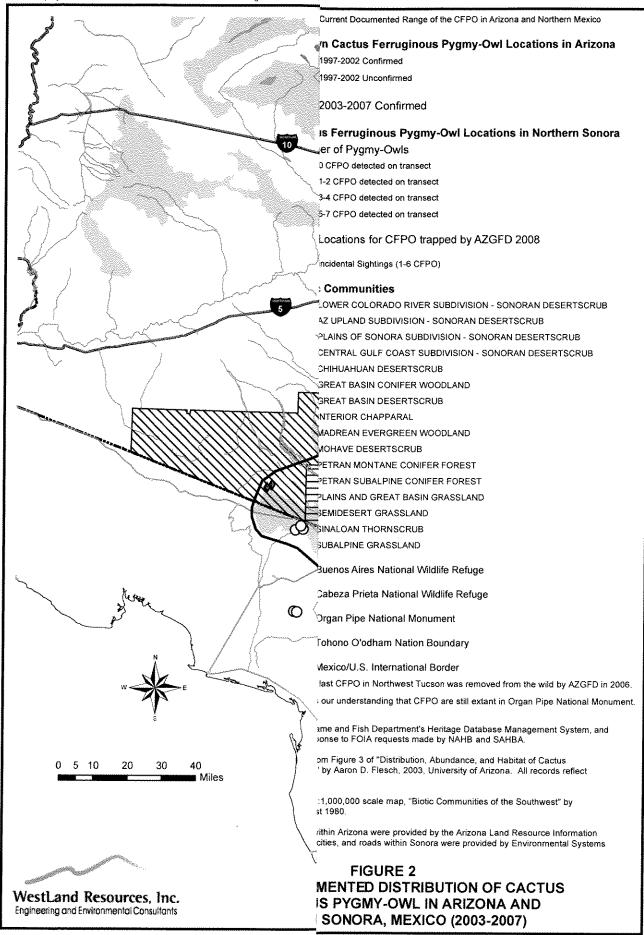
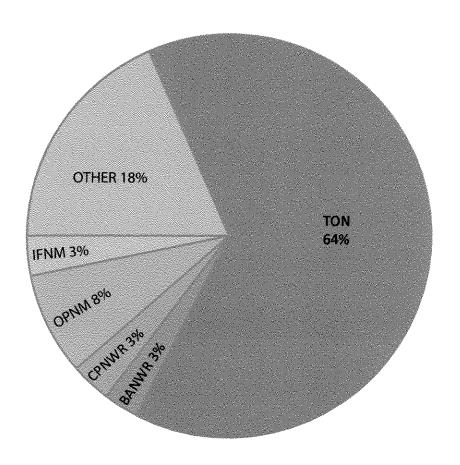


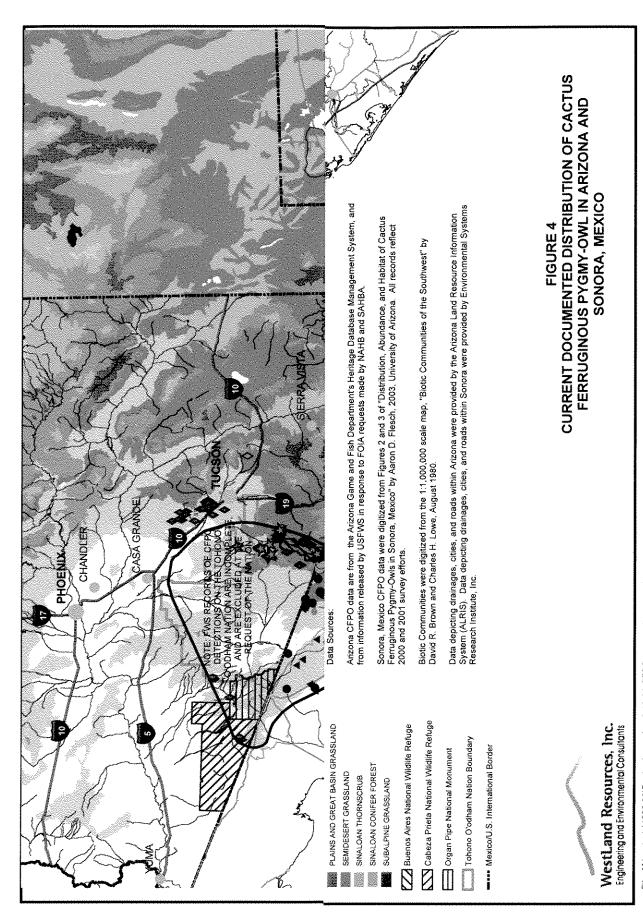
Figure 3. Breakdown of the Current Distrubution of CFPO in Arizona



Breakdown of Current Distribution of CFPO in Arizona

	Acres	Miles ²	Percentage
Total	3,995,638	6,244	100%
Tohono O'Odham Nation (TON)	2,560,737	4,001	64%
Buenas Ares National Wildlife Refuge (BANWR)	112,261	175	3%
Cabrea Preta National Wildlife Refuge (CPNWR)	128,997	202	3%
Organ Pipe National Monument (OPNM)	328,925	514	8%
Ironwood Forest National Monument (IFNM)	129,000	202	3%
Other*	735,718	1,150	18%
Northwest Tucson (NWT)	0	0	0%

^{*}Includes a mix of private property, state trust lands, BLM, USFS, Pascua Yaqui Nation, and other publically held lands.



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DISTRIBUTIONAL HISTORY AND CURRENT STATUS OF THE CACTUS FERRUGINOUS PYGMY-OWL

(Glaucidium brasilianum cactorum) IN ARIZONA

R. Roy Johnson, Ph.D.1 and Steven W. Carothers, Ph.D.2

Abstract -- Early Arizona specimen and literature records show that the Cactus Ferruginous Pygmy-Owl (CFPO) was an uncommon species in central and southern Arizona, at best locally common as an obligate or preferential wet riparian species in cottonwood-mesquite (Populus-Prosopis) vegetation along intermittent and perennial streams. The historical record, as documented by museum specimens and published literature, during the first 100 years after the species' discovery in the U.S., clearly shows that several current concepts about the species are inaccurate (Johnson et al. 2003). Some of these misconceptions addressed here and discussed further in this paper include the following: (1) The CFPO was originally a common bird, especially in southern Arizona. (2) The CFPO commonly occurs in upland Sonoran Desertscrub, or at least in xeroriparian ecosystems along desert washes, and they most often nest in saguaro cacti (Carnegica gigantea). (3) The CFPO population in the Sonoran Desert of southern Arizona and northwestern Mexico is distinct from CFPOs in other habitat types. (4) Mexico's CFPOs are found in tropical-subtropical climatic zones, while those in the U.S. are in a different region. (5) CFPO's numbers have been severely reduced by urban and rural development during the mid to late 1900s. (6) There is a gap in the distribution between the CFPOs in Arizona and those in NW Mexico. (7) The Arizona population of CFPOs constitutes a significant portion of the species' (subspecies') distribution and occupies a significant portion of the total acreage for the CFPO. (8) The CFPO was formerly as common in the Phoenix and Gila River regions (at the extreme northern end of the entire Ferruginous Pygmy-Owl's range) as the Tucson region. (9) The CFPO has always been a permanent resident in southern Arizona within historical times. (10) Attention should be focused on the Sonoran Desert population of CFPOs. (11) CFPO populations in undisturbed, "pristine" Sonoran Desert areas are the healthiest; thus, CFPOs in southern Arizona are not in as much danger of being extirpated as those in areas of agricultural development in Mexico. (12) The CFPO population in northwest Tucson and adjacent southern Pinal County needs to be conserved and, if necessary, reestablished through implementation of owls from another source. (13) The Arizona population of CFPOs is a discrete population segment. The concept that this is a stable population applies only to the state as a whole but not to populations at any given locality.

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INTRODUCTION

The Ferruginous Pygmy-Owl (Glaucidium brasilianum) is considered by many to be the most common owl in the tropical Americas. This is perhaps due in part to being more often detected because of its diurnal and crepuscular (dawn and dusk) habits. In the tropics it is a common bird of a wide variety of habitats, including edges of streams, villages, and agricultural lands (de Schauensee 1970, Howell and Webb 1995, RRJ). The northernmost subspecies, Cactus Ferruginous Pygmy-Owl (Glaucidium brasilianum cactorum), hereafter CFPO, is so rare in Arizona that it has been declared an endangered species by the U.S. Fish and Wildlife Service (USFWS; 1997). The CFPO has been extirpated from the Phoenix region of central Arizona where it was sometimes considered a relatively common species at the turn of this century (Millsap and Johnson 1988, Johnson et al. 2000, Johnson et al. 2003). There it nested in cottonwood-mesquite (Populus-Prosopis) woodlands and forests, usually in cavities excavated by the Gila Woodpecker (Melanerpes uropygialis) and Gilded Flicker (Colaptes chrysoides).

The CFPO was first discovered in the United States at Camp Lowell (later Fort Lowell), near Tucson, Arizona, by Charles Bendire on 24 January 1872 (Coues 1872, Bendire, 1888, 1892). After that time it was too often considered a common to fairly common permanent resident in the Sonoran Desert of central and southern Arizona when, in fact, it has always been an uncommon bird. From the late 1800s through the early 1900s a score of ornithologists and bird and egg collectors visited southern Arizona. Most of them sought birds in the lowlands around Tucson, where Mexican birds³ extended their ranges north from Mexico (Appendix A).

Several early workers concentrated on the mountains of southeastern Arizona, so called "sky islands" consisting of coniferous forests isolated from one another by desert lowlands and grasslands (Carothers 1986, Brown and Davis 1994). Avifaunal lists were produced for several of these mountains and their Madrean avifaunas, many of the species coming from Mexico, e.g., for the Santa Rita Mountains (Bailey 1923) and Huachuca Mountains (Swarth 1904). Even when conducting studies in the mountains, researchers commonly came from other localities to Tucson, traveling through potential CFPO habitat in the lowlands surrounding Tucson and between the mountains. However, many of these ornithologists never recorded a CFPO, or at best recorded one or two CFPOs. Florence M. Bailey never reported the species in her eight papers on southern Arizona, and Swarth took only one specimen during numerous studies in southern Arizona, work that extended through four decades and resulted in more than a dozen papers on the Tucson region; see H. S. Swarth under Important Early Ornithologists, below.

One of the strongest indications of how uncommon the CFPO was is the lack of its mention in approximately 200 ornithological papers on southern Arizona during the late 1800s and early 1900s (Table1). Only one specimen in the Tucson region was taken (that of Swarth's in 1896) between 1984 and 1916 (Appendix B). We find no mention of a CFPO specimen in numerous writings by Allan R. Phillips, Arizona's leading full-time resident ornithologist and an accomplished specimen collector from the 1930s through the 1950s (Johnson et al. 1997). He

³ Species of plants and animals whose ranges extend northward a short distance into the U.S. from Mexico will be referred to throughout the paper as Mexican Species, or Mexican plants, Mexican birds, etc.

considered the CFPO a rare species and did not take a specimen in Tucson until 1948. Furthermore, he was surprised to find the two CFPOs he collected on the Salt River, at Blue Point Cottonwoods, upstream from Phoenix (pers. comm. to RRJ in Johnson et al. 2003).

Table 1. Professional and amateur ornithologists who published four or more papers on ecology and distribution of birds in southern Arizona during the late 1800s and/or early 1900s (Anderson 1972) without publishing a CFPO record.

Ornithologist	Dates of Publication	Number ² of Papers	
H. Brown	1885-1911	15 ³	
E. A. Mearns	1886-1911	6	
G. F. Breninger	1897-1905	10	
F. C. Willard	1898-1923	15	
O. W. Howard	1899-1906	7	
R. D. Lusk	1999-1921	6	
H. S. Swarth	1904-1933	12+	
M. F. Gilman	1909-1915	10	
F. M. Bailey	1922-1940	8	
L. Miller	1927-1957	7	
C. T. Vorhies	1928-1947	8	
L. M. Huey	1931-1944	6	
A, R, Phillips	1932-1962	7	
A. H. Anderson	1933-1965	27	
A. H. Miller	1936-1949	4	
G. Monson	1936-1942	5	
G. M. Sutton	1941-1953	4	

Some of the papers are on montane highlands, where no CFPO records would be expected. However, the author of these papers traveled through lowland habitats during his or her avian work where CFPOs should have been encountered if the species were common.

Most of the wet riparian habitat in the southwestern U.S. lowlands has been destroyed by water diversion projects, groundwater overdraft, wood cutting, raising of livestock, and other activities associated with rural and urban development (Dobyns 1981, Rea 1983, Johnson et al. 2000, Proudfoot and Johnson 2000). There is little direct evidence to show that rural and urban development, per se, directly affects the CFPO. However, activities associated with this development do affect the species. Habitat loss, especially the loss of trees for nesting, and loss of water associated habitats has been detrimental to the species in the southwestern U.S. In both Texas and Arizona diminishing of owl numbers has been associated with wet riparian habitat loss. In Texas, 90% of the lower Rio Grande Valley's riparian woodlands had been destroyed by the 1970s (Oberholser 1974) and in Arizona, a similar loss has occurred (Johnson and Jones 1977, Johnson and McCormick 1979, Dobyns 1981, Tellman et al. 1997, Johnson et al. 2003).

Numerous papers were published on southern Arizona during this period by ornithologists that published fewer than four papers.

³ Brown took a single CFPO on the Santa Cruz River south of Tucson, the only record for the Santa Cruz River (Johnson et al. 2003), but never published that record or anything else about the species.

Early CFPO records in Arizona were almost entirely from its primary habitat of wet riparian ecosystems along major lowland rivers. There was a direct correlation between plummeting CFPO populations and loss of cottonwood-mesquite habitat along these rivers in central and southern Arizona during the early 1900s (Johnson et al. 2003). Currently it is most commonly found in xeroriparian habitat along desert washes and in low density suburban housing developments, nesting in saguaro cacti. Most of the CFPO's distribution is in western Mexico where it is still a relatively common species occurring in a wide variety of habitats in addition to Sonoran Desert. Two of the most limiting factors for CFPO are trees with nest cavities and an adequate food base. Wet riparian ecosystems provide both factors while xeroriparian ecosystems along desert washes are second best and, finally, Sonoran Desertscrub uplands with saguaros (the only tree in much of the Sonoran Desertscrub in the U.S.). Conditions in much of northwestern Mexico are apparently more favorable to the survival of CFPOs, including warmer winter temperatures and greater annual rainfall, especially summer rains (Dunbier 1968, Turner and Brown 1982) and resultant food base important to survival of young owls.

MISCONCEPTIONS

The following common misconceptions about the CFPO are italicized, followed by facts and evidence refuting these misconceptions.

MISCONCEPTION 1--The CFPO was originally a common bird, especially in southern Arizona.

If the species had been common anywhere in Arizona the numerous expeditions to the southwestern U.S. during the late 1800s and early 1900s would have recorded more CFPOs (Fischer 2001, Johnson et al. 2003, Appendix C). A large body of evidence suggests that the owl was never common in Arizona. The collection of 39 owls and 11 sets of eggs in the entire state of Arizona from 1872-1953 (50 specimens in 81 years) hardly suggests a common bird (Tables 2 and 3). Some critics contend that members of these earlier expeditions overlooked CFPOs. CFPOs are generally not overlooked, especially in areas where they are common. It is one of the easier species of owls to detect for several reasons. They are active at all times of the day, are especially crepuscular (active at dawn and dusk), and one of the few owl species that are active during daylight hours. They may call at any time of the year and are generally easily observed as they call. They are also often mobbed by small birds, causing a commotion that draws attention to the owl sitting in a tree in broad daylight. Thus, the lack of records suggests that the species was generally uncommon but perhaps fairly common in local populations along perennial and intermittent watercourses (Johnson et al. 2003). An analysis of specimen distribution demonstrates the local, wet riparian occurrence of CFPOs in southern and central Arizona (Table 3). For example, 9 of the 12 museum skins from the Tucson region, taken during the first 50 years (1872-1921) after its discovery, are from Rillito Creek and a tributary, Sabino Canyon (Appendix B).

Table 2. Distribution of Cactus Ferruginous Pygmy-Owl specimens taken in Arizona by 20-year intervals during the first 100 years after its discovery. No known specimens have been taken in the state since 1953 (after Johnson et al. 2003, 2004).

Years	Tucson Area		Phoenix Area		C	Sila River	TOTAL	
	Birds	Egg Sets	Birds	Egg Sets	Birds	Egg Sets	Birds	Egg Sets
1872-1891	6	0	0	0	1	0	7	0
1892-1911	1	0	13	9	3 ¹	2	17	11
1912-1931	9	0	0	0	0	0	9	0
1932-1951	2 ²	0	3	0	0	0	5	0
1952-1971	1	0	0	0	0	0	1	0
TOTALS	19	0	16	9	4	2	39	11

¹ Includes one five bird taken at Agua Caliente and released later (Gilman 1909).

Table 3. Distribution of Cactus Ferruginous Pygmy-Owl specimens, including birds and eggs, taken in Arizona by 20-year intervals during the first 100 years after its discovery showing distribution in relation to wet riparian habitat. No know specimens have been taken in the state since 1953 (after Johnson et al. 2003, 2004).

	Tuc	Tucson Area		Phoenix Area		Gila River			TOTAL			
Years	Rip.	Non- Rip.	?1	Rip.	Non- Rip.	?1	Rip.	Non- Rip.	?1	Rip.	Non- Rip.	?1
1872- 1891	5	0	1	0	0	0	0	0	1 ²	5	0	2
1892- 1911	0	0	1	20 ³	0	2	4	0	0	25	0	3
1912- 1931	4	0	5	0	0	0	0	0	0	4	0	5
1932- 1951	2 ^{4,5}	0	0	3	0	0	0	0	0	5	0	0
1952- 1971	1	0	0	0	0	0	0	0	0	1	0	0
TOTA LS	12	0	7	23	0	2	4	0	1	40	0	10

¹ Unknown locations include labels that state only Tucson, Catalina Mountains, etc. without habitat notation or specific locality, e.g., Fort Lowell, Sabino Canyon, etc.

The CFPO is one of 35 species that extend northward across the border from Mexico into southern Arizona (Appendix A). It has always been an uncommon bird of local occurrence in Arizona ever since Bendire wrote that it was "not common" (Bendire n.d.). It was, at best, locally common at several wet riparian sites in southern and central Arizona. Only 39 CFPOs and 11 egg sets were taken in the entire state during the first 100 years after the discovery of this

² Includes a specimen taken by Moore on Indian lands at Fresnal, in the Baboquivari Mountains (Johnson et al. 2003).

² The specimen labeled as "Casa Grande" was probably found along the Gila River, which was known for its large mesquite forests (Davis 1982).

³ All labels that we have examined for specimens taken by Breninger were from along the Salt River in cottonwood trees.

⁴ Includes a specimen taken by Moore on Indian lands in the Baboquivari Mountains at Fresnal, noted for a large spring with ash trees, mesquites and other wet riparian growth (Barnes 1988).

⁵ A specimen taken by Phillips was in an irrigated yard with a pond [irrigated riparian] (Pers. Comm., A.R. Phillips).

owl in the U.S. (Johnson et al. 2003; see Tables 2 and 3 and Appendix B). These specimen records were found through an extensive literature search and contacting 40 museums that might have CFPO specimens (Johnson et al. 2003). Such small numbers of CFPO specimens are amazing when one considers the large number of professional and amateur ornithologists and bird and egg collectors that were active in Arizona during this period. Numerous professional and amateur collectors traveled to southern Arizona during the late 1800s, amassing several thousand birds and egg sets, perhaps as many as ten thousand or more, and published dozens of papers on birds of the region (Table 1); see *Important Early Ornithologists and Collection Sites*, below.⁴ Out-of-state collectors, many of them nationally recognized avian experts, included C. E. Bendire, F. Stephens, W. E. D. Scott, E. A. Mearns, F. K. Fisher, H. S. Swarth, and W. L. Dawson (see Table 4 and Appendix B). Resident ornithologists and collectors included H. Brown, R. D. Lusk, O. W. Howard, G. F. Breninger, M. F. Gilman, and E. C. Jacot.

Table 4. Collectors and numbers of CFPOs taken by each person in Arizona. Note that of the 19 people who collected CFPOs and eggs, 11 took either only a single bird or one set of eggs.

Collector	CFPO Specimens	Egg Sets	Dates
G. F. Breninger	9	6	1896-1905
H. H. Kimball	8	0	1918, 1920-1922
M. F. Gilman	3	2	1908
A. R. Phillips	3	0	1948, 1949, 1951
C. E. Bendire	2	0	1872
F. Stephens	2	0	1881, 1884
A. K. Fisher	2	0	1892
R. D. Lusk	1	1	1895
H. Brown	1	0	1884
E. W. Nelson	1	0	1884
E. A. Meams	1	0	1885
R. A. Campbell	0	1	1895
W. B. Judson	1	0	1896
H. S. Swarth	1	0	1896
F. W. Bennett	0	1	1897
A. B. Howell	1	0	1916
L. L. Hargrave	1	0	1933
R. T. Moore	1	0	1933
J. T. Marshall	1	0	1953
TOTALS	39	11	

⁴ Due to a method of "cross indexing" in this paper the same information may occur several times. For example, information about the collection of CFPOs by Frank Stephens at Fort Lowell may appear in introductory material, under the section on Frank Stephens, and under the section on Fort Lowell.

MISCONCEPTION 2-- The CFPO commonly occurs in upland Sonoran Desertscrub, or at least in xeroriparian ecosystems along desert washes. They most often nest in saguaro cacti (Carnegiea gigantea), the major tree of the Sonoran Desert in Arizona.

Although restricted to the Lower Sonoran Zone in Arizona (Phillips et al. 1964, Monson and Phillips 1981), whether in wet riparian, xeroriparian, or desertscrub, the CFPO inhabits a broad range of habitats in western Mexico (see Distribution and Systematics, Background, below). Both Bendire (1888, 1892) and Breninger (1898) separated nesting of the CFPO from Elf Owls by the fact that CFPOs nested in mesquite (Prosopis juliflora) and cottonwoods (Populus fremontii) and Elf Owls nested in saguaros; see accounts for Bendire and Breninger under Important Early Ornithologists, below. Beginning with Bendire's writings into the early 1900s, cottonwood-mesquite ecosystems were mentioned as playing a dominant role in the species existence in Arizona (Bent 1938, Millsap and Johnson 1988). The specimens that we have examined commonly mention cottonwoods and/or mesquites along perennial or intermittent streams or else are not specific about habitat.

MISCONCEPTION 3-- The CFPO population in the Sonoran Desert of southern Arizona and northwestern Mexico is distinct from CFPOs in other habitat types.

There is no evidence, genetic or otherwise, that this is true. The habitat types occupied by the CFPO in Mexico, other than Sonoran Desert, include, in Sonora, oak (*Quercus* spp.), Montezuma baldcypress (*Taxodium mucronatum*) (Russell and Monson 1998); Thornscrub and Thorn Forest of Colima and Jalisco (Schaldach 1963); at the edges of banana (*Musa paradisiaca*) and coconut (*Cocos nucifera*) plantations in Jalisco (RRJ, Lois T. Haight, pers. comm.), and "semiopen areas with hedges and scattered forest patches, open forest and edges" (Howell and Webb 1995:363). The Ferruginous Pygmy-Owl in the Peruvian Amazon Rainforest occurs as a wet riparian bird, at clearings around villages and plantations, and behaves and sounds like the CFPOs in Arizona (RRJ, Lois T. Haight, pers. comm.).

MISCONCEPTION 4-- Mexico's CFPOs are found in tropical-subtropical climatic zones while those in the U.S. are in a different region.

In their enthusiasm to make the Arizona population of CFPOs seem "unique" some USFWS biologists have erroneously separated the Mexican and Arizona populations by biogeographic region. The proposed rule for de-listing states "Approximately three quarters of the distribution of the pygmy-owl occurs within tropical and subtropical plant communities. This includes pygmy-owls of southern Texas south through the Mexican states of Tamaulipas and Nuevo Leon.... Approximately one quarter of the distribution of pygmy-Owls falls within desert plant communities. This includes pygmy-owls in Arizona south through western Mexico. . . . In Arizona, the pygmy-owl is found within Sonoran Desert scrub or semidesert grassland biotic communities.... "(USFWS 2005:44549). Brown (1994) is referenced for this differentiation of biotic communities. The inaccuracy of this separation is clear when referring to Brown (1982, 1994) who places both of these Sonoran Desert biotic communities in southern Arizona in Tropical-Subtropical Desertlands (Brown 1982:311).

MISCONCEPTION 5--CFPO's numbers have been severely reduced by urban and rural development during the mid to late 1900s.

A rapid decline of the species began in the early 1900s (Millsap and Johnson 1988), a decline that was correlated with water projects (especially reclamation projects) throughout central and southern Arizona (Johnson et al. 2003). Little information was published regarding the decline of the CFPO before Phillips et al. (1964:52) pointed out that "this bird is most frequently seen at the mouth of the Verde River and eastward. It is now rare and local at Tucson." This statement was based on the fact that the last three specimens for the Phoenix Region had been collected along the Salt River at Blue Point Cottonwoods, near the mouth of the Verde River (Appendix B). By 1964, when *The Birds of Arizona* was published (Phillips et al. 1964), the species had also become rare at Blue Point Cottonwoods, last recorded there 14 May 1971 (Millsap and Johnson 1988, Johnson et al. 2000, 2003). This was also the last record for the Phoenix region (RRJ).

The CFPO has never been recorded along the Verde River itself (Johnson and Simpson, ms.). As late as 1981 ornithologists were still writing "has declined considerably . . . since 1950" (Monson and Phillips 1981:72). Monson later accepted that "its drastic decline began about 1900 (Millsap and Johnson 1988)" (Monson 1998:160). Below, we discuss other Mexican species whose numbers have fluctuated wildly in Arizona, e.g., the Rufous-winged Sparrow, or who have been extirpated, e.g., the Aplomado Falcon (Falco femoralis). All of these species, including the CFPO, are at the northern extreme of their ranges in southern Arizona. Such changes in a species' populations is to be expected at the extremes of its distributional range.

MISCONCEPTION 6-- There is a gap in the distribution between the CFPOs in Arizona and those in NW Mexico.

At the time of listing of the CFPO as an endangered species (USFWS 1997) some ornithologists believed this to be the case. The inaccuracy of this misconception has been known since the 1930s and made known through at least three publications (van Rossem 1931, 1945; Russell and Monson 1998). This was based, at least partially, on information from Gale Monson. Monson is an experienced ornithologist, coauthor of many publications on birds, including the *authoritative The Birds of Arizona* (Phillips et al. 1964), *Annotated Checklist of the Birds of Arizona* (Monson and Phillips 1981), and *The Birds of Sonora* (Russell and Monson 1998). Monson stated that the CFPO "is not common in adjacent Mexico within 100 miles of the border" (1998:161). On questioning Monson he does not know where this information came from (pers. comm. to RRJ, July 2005).

In his account of the CFPO, Monson (1998) was wrong in at least two assumptions. Actually, CFPOs are common in most of northern Sonora, Mexico, from the U.S.-Mexican boundary southward (Flesh and Steidl 2000, 2002, Flesch 2003). In addition, Monson wrongly stated "Organ Pipe Cactus National Monument apparently has always supported a small population [of CFPOs]" (1998:160). In fact, the CFPO was apparently not at Organ Pipe until the 1940s, when it was discovered by Hensley in Alamo Canyon in 1949 (Hensley 1951, 1954, 1959). Previous

to that time nationally known ornithologists had conducted investigations in Organ Pipe and published numerous papers without finding the CFPO. These included Mearns (1907), U.S.-Mexico Boundary Survey; van Rossem (1936, 1937) who described the CFPO as a new subspecies; Huey (1942) from the San Diego Museum of Natural History; Phillips, Arizona's leading ornithologists (Phillips and Pulich 1948); and A. B. Howell of the U.S. Biological Survey (Groschupf et al. 1988). At least three of these—van Rossem, Huey, and Phillips—worked in Alamo Canyon, where the CFPO has been most commonly found since its discovery in 1949.

MISCONCEPTION 7-- CFPOs in Arizona constitute a significant portion of the species' (subspecies') population and distribution range and occupy a significant portion of the total acreage for the CFPO.

This is also a misconception that becomes clear when one examines the small area occupied by the species in southern Arizona compared to the much larger area in Mexico. At the most, the CFPO distributional range is less than 4,000,000 acres in Arizona and much, if not most, of that has no CFPOs. By contrast, approximately half of the area occupied by CFPOs in Sonora, Mexico, is Sonoran Desert, or approximately 15,000,000 acres (Russell and Monson 1998). In addition, an estimated 50,000,000 acres of other ecosystems is also occupied by the CFPO in western Mexico. Thus, the Sonoran Desert portion of the species range in Mexico is approximately four times that of the Arizona population and the total Mexican acreage occupied by the CFPO is an estimated 65,000,000 acres, or more than 15 times the area occupied by the CFPO in the U.S. (Table 5). Additionally, population densities reported for Mexico are generally considerably greater than for known densities in the United States (Flesch 1999, Abbate et al. 1999, Abbate et al. 2000, Flesh and Steidl 2000, 2002, Flesch 2003, Johnson and Carothers 2003).

MISCONCEPTION 8-- The CFPO was as common in the Phoenix and Gila River regions (at the extreme northern end of the entire Ferruginous Pygmy-Owl's range) as the Tucson region.

If the CFPO had been common anywhere in Arizona many more museum specimens and early records would be in existence today; see discussion under *Important Early Ornithologists and Collection sites*, below. The CFPO was found at more sites in southern Arizona than central Arizona, especially if the Tohono O'odham Nation, and Organ Pipe Cactus National Monument are included. We know of only four localities in the Phoenix Region where CFPOs and/or eggs were collected, all wet riparian habitat sites: New River (Fisher 1893); Cave Creek; Salt River at Phoenix (Breninger 1898); and Blue Point Cottonwoods, on the Salt River near its confluence with the Verde River (Johnson et al. 2000, 2003, 2004). All 10 of the CFPOs collected at Phoenix between 1895 and 1905 were taken by Breninger who also collected six of the eight sets of eggs taken at Phoenix during the same period (Johnson et al. 2003; see Table 4 and Appendix B). Breninger's specimen labels that we have examined mention cottonwood trees along the Salt River. See *George Breninger*, under *Important Early Ornithologists*, below.

Table 5. Acres of estimated CFPO habitat currently in Mexico and Arizona (after Am. Ornithol. Union 1957, 1997, Howell and Webb 1995, Russell and Monson 1998, Proudfoot and Johnson 2000, RRJ).

State ¹	Km²	Mi ²	% CFPO Habitat	Acres CFPO Habitat	TOTAL Acres CFPO Habitat
MEXICO					64,968,800
Sonora ²	184,934	71,373	75% ³	34,259,040	• • • • • • • • • • • • • • • • • • • •
Sinaloa	58,092	22,420	100%	14,348,800	
Nayarita ⁴	27,621	10,660	75% ⁵	5,116,800	
Jaliscoa ⁴	80,137	30,928	50% ⁵	9,896,960	
Colima⁴	5,455	2,105	100%	1,347,200	
Michoacan ⁶		(Eastern I	Population, see tex	t)	
S. ARIZONA ⁷		6,000			3,800,000
TOTAL					68,768,800

¹ After Paxton (1978).

MISCONCEPTION 9-- The CFPO has always been a permanent resident in southern Arizona within historical times.

This has been an assumption of ornithologists through historical time (Swarth 1914, Phillips et al. 1964, Monson and Phillips 1981, Millsap and Johnson 1988, Am. Ornithol. Union 1997, Monson 1998). However, an examination of the specimen and published record from the mid-1800s to the present shows large gaps in both time and space in Arizona (Appendix B). First, there were no documented records from the entire Gila River region between 1908 (Gilman 1909) and 1971 (Johnson et al 2003, Appendix B). Secondly, there have been large gaps in the record in both the Tucson and Phoenix regions (Johnson et al. 2003, Appendix B). Finally, on the Papago Indian Reservation and Organ Pipe Cactus National Monument, where the species is presently most common in Arizona, there were no records for decades (Johnson et al. 2003, Johnson and Carothers 2003). This was in spite of numerous ornithologists (some of them with outstanding national reputations) visiting those areas and finding no CFPOs during hundreds of days of study; see *Organ Pipe Cactus National Monument and Papago Indian Reservation (Tohono O'odham Nation)*, below. It is possible that the CFPO is erratic in Arizona, appearing

After Russell and Monson (1998).

^a See text for discussion of excluded areas, largely upper Gulf of California coast lowlands an the west and Sierra Madre Occidental to the east.

⁴ Phillips (1966) named *Glaucidium brasilianum intermedium* as an intermediate subspecies, from southern Nayarit south, between the CFPO (*G. b. cactorum*) and the subspecies in southern Mexico, *G. b. ridgwayi*. The scientific validity of *G. b. i.* has not been verified and since Proudfoot and Slack=s (2001) work has not been published and they had no samples from these states we continue to call them CFPOs (see text for further discussion).

⁵ See text for discussion of excluded areas, largely Sierra Madre Occidental in eastern part of state.

⁶ According to Proudfoot and Slack (2001) CFPOs from Michoacan (Am. Ornithol. Union 1957) are more closely related to the subgroup of CFPOs from eastern Mexico and southern Texas. Therefore we exclude this area from our discussion, restricting CFPOs to Arizona and northwestern Mexico.

Area extending from NW Tucson, adjacent s. Pinal County and Silver Bell Mountains, south to Buenos Aires NWR and east across the Tohono O'odham Nation through Organ Pipe Cactus National Monument. Information about distribution of owls on the Nation=s lands is incomplete and has been obtained from members of the CFPO Technical Recovery Team and other unidentified sources.

and disappearing over time, in a manner similar to the Rufous-winged Sparrow (Aimophila carpalis); see the Case of the Disappearing Rufous-winged Sparrow, below.

MISCONCEPTION 10-- Attention should be focused on the Sonoran Desert population of CFPOs, especially in Arizona because management practices most favor the species' (subspecies') survival.

This is, perhaps, the most flawed of the misconceptions discussed here. The vast majority of the Ferruginous Pygmy-Owl populations (consisting of other subspecies than *cactorum*) in North, Central, and South America, live in non-desert environments (Schaldach 1963, de Schauensee 1970, Peterson and Chalif 1972, Burton 1984, Howell and Webb 1995, Russell and Monson 1998, Proudfoot and Johnson 2000). Additionally, as pointed out under misconception 6, above, an estimated approximately 50,000,000 acres of habitat types other than Sonoran Desert is occupied by the CFPO (Proudfoot and Slack's WP [Western Population]) in western Mexico, many times that of the desert area occupied by the CFPO, or WP (Table 5). The Arizona population of CFPO has declined steadily ever since intensive studies began in the 1990s and probably during most of the 1900s as discussed throughout this paper. There is no proof that the expensive efforts of augmentation, further protection, e.g., setting up additional conservation areas, etc. will stop the demise of the CFPO.

MISCONCEPTION 11-- CFPO populations in undisturbed, "pristine" desert areas are the healthiest. Thus, CFPOs in remote Sonoran Desert areas of Arizona are not in as much danger of being extirpated as those in areas of agricultural development in Mexico.

Prime, primary wet riparian habitat of the CFPO in Arizona was degraded and destroyed during the early 1900s, resulting in a drastic population crash (Millsap and Johnson 1988, Monson 1998, Johnson et al. 2003). The most studied CFPO population in Arizona during recent times was in NW Tucson and adjacent Pinal County (Abbate et al. 1996, 1999, 2000), was discovered during the late 1970s and early 1980s (Monson 1998, B. Bristow pers. comm. to R. Johnson). This NW Tucson population of CFPOs lives in a mixture of "original desert vegetation" and "exotic plants" (Monson 1998:160) associated with low density "suburban ranchette" development and may be termed "cultivated riparian habitat." Cultivated riparian habitat is associated with human habitation, often consisting of a mixture of native vegetation and exotic trees, shrubs, and/or lawns, and sometimes irrigated agricultural fields. Additionally, open water associated with such developments often consists of stock tanks, fish ponds, and swimming pools. Food for domestic animals is common in these low density suburban developments and also provides food for small vertebrates, especially birds and mammals, e.g. rodents. This often results in artificially high populations of these vertebrates and, in turn, increases the prey base for predators such as the CFPO. Habitat studies conducted during 1997 and 1998 by Arizona Game and Fish Department (AGFD) personnel in NW Tucson showed that all 21 sites studied for CFPO perch and nest sites "were within residential areas of varying density. Most houses were on a 3- to 5-acre parcels [sic] of land with one to two houses on the property" (Wilcox et al. 1999:17). Also, both exotic and native species were listed for woody vegetation used by CFPO. Thus, the idea that the NW Tucson population is located in "pristine" desert habitat is not

substantiated by the AGFD's own studies. Although low density suburban development in the Tucson basin would seen to be ideal for the CFPO, this habitat that attracts CFPOs so readily comes with deleterious effects discussed immediately below, in (11).

MISCONCEPTION 12-- The CFPO population in NW Tucson and adjacent southern Pinal County needs to be conserved and, if necessary, reestablished through implementation of owls from another source.

Within the Tucson Basin, AGFD survey records indicate that in 1999, 17 adults occupied 11 sites; in 2000, 14 adults occupied 10 sites; in 2001, 8 adults occupied 5 sites; and in 2002, 3 adults occupied 3 sites (USFWS 2000; USFWS 2001; AGFD personnel, pers. comm.). Prior to that time perhaps as many as 20 or more CFPOs occupied this area. By now, 2005, no CFPO breeding is known within the Tucson Basin. Attempts to reestablish this population would probably be futile. Recovery efforts on the Buenos Aires NWR with the Masked Bobwhite Quail (Colinus virginianus ridgwayi) during the past two decades have not been successful. A major reason given for this unsuccessful effort is predation by raptors, especially hawks (USFWS personnel, Buenos Aires NWR, pers. comm.). A similar story is presented for mortality for the CFPO with 52% of known losses occurring from predation, mostly by raptors (AGFD figures). Other losses in the Tucson Basin have been from cats, cars, and other factors associated with human settlements (AGFD personnel, pers. comm.). Thus, there is every indication that expensive attempts to reestablish the NW Tucson population would meet with failure.

MISCONCEPTION 13-- Persistence of the discrete population segment [USFWS 2005:44549]. The concept that this is a stable population applies only to the state as a whole but not to populations at any given locality.

The CFPO has shown a spotty and unstable population at any given spot in Arizona throughout history. Although there is no proof that the CFPO is more or less common in Arizona today than at any time, the historical record has shown several shifts in its occurrence throughout central and southern Arizona (Millsap and Johnson 1988, Johnson et al. 2003). During the late 1800s and early 1900s the species was reported largely from three basic localities: Rillito Creek and tributaries near Tucson, the middle and lower Gila River, and Salt River near Phoenix and tributaries, including Cave Creek and New River. There were no reports of a population from the uplands anywhere in the state and none from any habitat type in southwestern Arizona, e.g., the Tohono O'odham Nation (at that time, Papago Indian Reservation) and Organ Pipe.

By the mid-1900s the species had disappeared from the middle and lower Gila River, was relatively rare along Rillito Creek (Brandt 1951), and even more rare in the Phoenix area, all paralleling the development of water projects that caused desertification of these stream systems (Johnson and Simpson 1988). However, with the development of water for people and livestock in southwestern Arizona, e.g., on the Tohono O'odham Nation (at that time, Papago Indian Reservation) and Organ Pipe, CFPOs began to be recorded (Hensley 1951, 1954, 1959; Johnson et al. 2003). These were the first sizeable upland populations reported for Arizona.

By the late 1940s and early 1950s there were scattered upland reports for the CFPO from Sonoran Desertscrub vegetation in the Tucson area (Brandt 1951, Johnson et al. 2003) and by the 1970s the NW Tucson population was discovered.

DISTRIBUTION AND SYSTEMATICS BACKGROUND

The CFPO is a member of the species *Glaucidium brasilianum* (Ferruginous Pygmy-Owl). This largely tropical and subtropical species ranges from the southwestern United States (southern Arizona and Texas) to Tierra del Fuego, at the southern tip of South America (Grossman and Hamlet 1964, Burton 1984). Thus, southern Arizona is not only the northernmost location for the CFPO but for the entire species, which consists of approximately 11-14 named subspecies, depending on the reference consulted (Peters 1940, Clark et al.1978, Howard and Moore 1991, Freethy 1992). In Arizona, the Ferruginous Pygmy-Owl is limited to the Lower Sonoran Zone, rarely occurring above 3,000 ft. elevation (Phillips et al. 1964, Monson and Phillips 1981, Proudfoot and Johnson 2000). South of the U.S. the species occurs in a wide variety of habitats (Proudfoot and Johnson 2000), in western Mexico occurring up to 4,000 ft. (Friedmann et al.1950) and as high as 6,000 ft. in Honduras (Monroe 1968).

The CFPO occurs from the Southwestern U.S., southward to south-central Mexico where it is replaced by the subspecies G. b. ridgwayi. Recent mtDNA analysis has raised some uncertainty regarding the lack of separation, or separation, of southern Arizona and southern Texas birds. Earlier works that recognized both Arizona and Texas populations as G. b. cactorum include Friedmann et al. (1950), American Ornithologists' Union Check-list (1957), Phillips et al. (1964), Oberholser (1974) and Johnsgard (1988). Others theorize that cactorum occurs in Arizona and another taxon, perhaps another subspecies such as ridgwayi, or even an unnamed subspecies, occurs in Texas (see discussion in Proudfoot and Johnson 2000). This theory has not been widely accepted by the scientific community.

ARIZONA FERRUGINOUS PYGMY-OWL VS. TEXAS FERRUGINOUS PYGMY-OWL: WESTERN (WP) VS. EASTERN POPULATION (EP)

Regardless of the proper taxonomic designation for the two populations, the Ferruginous Pygmy-Owl in northern Mexico and the southwestern U.S. can be divided into an eastern (EP) and western population (WP), based on geographic distribution and recent mtDNA analysis (Proudfoot and Slack 2001). This analysis was conducted with WP birds from Arizona and the NW Mexican states of Sonora and Sinaloa. The EP birds used in the study came from several eastern Mexican states and southern states such as Michoacan and Oaxaca. However, the mtDNA work of Proudfoot and Slack (2001) needs to be published for peer review in order to be considered scientifically valid by the scientific community for determining subspecific identification of the two populations.

For purposes of our discussions we recognize WP owls as occurring from southern Arizona, down the west Mexican coast north of Michoacan as CFPOs since G. b. cactorum was described

from southern Sonora (van Rossem, 1937). This includes the Mexican states (from north to south) of Sonora, Sinaloa, Nayarit, Jalisco, and Colima. We recognize EP birds as those from Michoacan (following Proudfoot and Slack's findings), across south-central Mexico and up through eastern Mexico to Texas without assigning a subspecific name to the eastern population. The Ferruginous Pygmy-Owls from s. Nayarit southward may be a different subspecies, G. b. intermedium (Phillips 1966). However, both the identity of the EP as a separate subspecies (whether G. b ridgwayi or otherwise) from the WP and the validity of intermedium as a distinct subspecies are in question. Phillips was a taxonomist that named species and subspecies almost entirely on morphological and ecological grounds without the advantage of more recent tools such as mtDNA analysis. Phillips' Ferruginous Pygmy-Owl subspecies, intermedium, was one of approximately 160 taxa that he named between 1939 and 1994, some of which have been accepted by the ornithological community and others not (Dickerman and Parkes 1997). Additionally, Proudfoot and Slack had no material for analysis from the WP states where intermedium is said to occur.

FORMER STATUS OF THE CFPO IN ARIZONA: PHOENIX, GILA RIVER, AND TUCSON REGIONS

A large body of evidence, especially published and specimen records, suggests that the CFPO was never common in Arizona. A thorough search of historical literature accounts and specimen records from museums throughout the U.S. show that the species was never widespread or common in Arizona but, at best, was locally common only at scattered localities in cottonwood and mesquite ecosystems along major streams. Although the species was considered by some early ornithologists to be a fairly common to common bird in central and southern Arizona during the late 1800s and early 1900s we here present evidence to the contrary. For specific river localities, for example, early workers wrote that the species along the Salt and Gila Rivers of the Phoenix region was "of common occurrence" (Breninger 1989:128). The species general abundance was described in the first state checklist as "apparently restricted to the valley of the upper Gila River, and its tributaries (Salt River, Santa Cruz River, etc.), where it is not uncommon" (Swarth 1914:31). However, in nearly all such cases, these statements were based on few sightings and specimens (commonly one or two) at given localities.

At the height of collecting activity for the CFPO, the 40 years from 1872 to 1911, only 21 specimens and 11 sets of eggs were collected for the entire state (Johnson et al. 2003; see Table 2 and Appendix B). Nearly all of these early specimens and/or literature records are the from wet riparian habitat along Rillito Creek and tributaries, near Tucson; the Gila River; and the Salt River and tributaries, near Phoenix. Compared to the total CFPO specimens taken from 1872 to the present, there was a relatively large number of CFPOs collected during this 40-year period. This may be at least partially due to the fact that numerous ornithologists came to central and southern Arizona during the late 1800s and early 1900s in search of Mexican species. It was during this period that professional collectors took thousands of birds, nests, and eggs in Arizona (see accounts of individual collectors, below). For example, just one of the many ornithologists that came to Arizona at that time, W. E. D. Scott, took a leave of absence from the Princeton Museum, Plainfield, New Jersey, in 1881-1886 to study and collect birds in southern Arizona.

He collected 2,500 specimens, which are now in the American Museum of Natural History (Allan 1910, Palmer et al. 1954). Thus, when one views this relatively small number of CFPO specimens compared to the total number of birds taken in Arizona at that time it adds credibility to the thesis that the species was, indeed, uncommon.

An illustration of how actual records differ from perceptions can be surmised from early records from Camp (later, Fort) Lowell, along Rillito Creek near Tucson. Most of the early Tucson area records were from Rillito Creek and tributaries, e.g., Sabino Canyon. This was where Bendire first discovered the CFPO for the U.S. on 24 January 1872, at Fort Lowell (Coues 1872, Bendire, 1888, 1892). Here, he collected two specimens, a male and a female. At the time Bendire considered the species "not common" (Bendire n. d.). A large part of the perception that the CFPO was common apparently was due to fact that several ornithologists later visited Fort Lowell and collected CFPOs, at widely scattered dates, but only one bird at any given time. In Bendire's field notes, he did not again mention the species during his two-year stay from June 1871-January 1873 (Hume 1978) in southern Arizona, despite traveling widely in the Tucson region. See also Bendire, under Important Early Ornithologists, below. Only nine years later, Frank Stephens spent the 1881 breeding season in southeastern Arizona, collecting several hundred birds in the Tucson area (Brewster 1882, 1883). Despite numerous attempts Stephens found and took only one CFPO in the entire Tucson region, at Camp Lowell. A similar situation pertains to specimens from Phoenix, Arizona, where almost all of the birds and eggs collected were by Breninger along the Salt River, between 1896 and 1905; see also Breninger, under Important Early Ornithologists, below.

The first publication of a record for CFPO in the Phoenix Regions was 35 miles north of Phoenix at New River, 35 miles north of Phoenix, in 1892 (Fisher 1893). This is not only the northernmost record for the CFPO but for the entire species, the Ferruginous Pygmy-Owl (Proudfoot and Johnson 2000). At New River, the CFPO was described as "quite common...among the mesquit [sic] and other shrubbery scattered through the groves of giant cactus [saguaros]" (Fisher 1893:199). Only two specimens, taken on the same day, would not seem to indicate the species was at all common; for more about the species being found at New River on only this single occasion see also Mearns, under *Important Early Ornithologists*, below.

Similarly, early records from the Gila River show only three museum skins, two sets of eggs, and one live bird captured. Three of these specimens were collected on the Gila River Indian Reservation and then a hiatus of more than 100 miles downstream to Agua Caliente (Johnson et al. 2000, Johnson et al. 2004). The only other record from the Gila River is an 1876 sight record more than 100 miles upstream from the Gila River Indian Reservation records (Aiken 1937, Johnson et al. 2003). Six records, over a 33-year period, along approximately 300 miles of river hardly constitute what one would call common, yet Gilman called them "fairly numerous" along the Gila River from the Gila River Indian Reservation, downstream to Agua Caliente (Gilman 1909:148); see Gilman, under *Important Early Ornithologists*, below.

The CFPO was prominently missing in dozens of papers that were published on studies conducted in southern and central Arizona during the late 1800s and early 1900s. Some of the

nation's leading ornithologists traveled to southern Arizona from some of the best known scientific institutions, especially to study Mexican species and other Sonoran Desert species that were poorly known at that time. Here, we give only a few examples. The CFPO was not mentioned in papers published by Swarth (1905), Willard (1912), Monson and Phillips (1941), Monson (1942), and dozens of others. No CFPO was found near Tucson in 1917, by a field crew of four persons from the Santa Barbara Museum in California. These four men spent most of their time from 7 May to 14 June 1917, in the San Xavier mesquite forest on the Santa Cruz River near Tucson. During this time more than 100 person-days of work was spent in preparation of skins, eggs, and a list of birds for publication (Dawson 1921). This collecting party found hundreds of nests, including 50 nests of Lucy's Warbler (*Vermivora luciae*) and 60 nests of the Vermilion Flycatcher (*Pyrochephalus rubinus*), but no CFPO birds or nests (Dawson 1921).

Another ornithological expedition that should have found CFPOs (if they had been common) was that of A. C. Bent, editor of Bent's *Life Histories of North American Birds* (Bent 1919-1968). In the spring and summer of 1922, with Frank Willard as a guide, Bent spent two months traveling throughout southern Arizona (Brandt 1951, Fischer 2001). Willard was an outstanding amateur ornithologist from Tombstone, Arizona. In addition to being one of the best known field man of his time (Fischer 2001) he publishing numerous papers on southern Arizona birds but none listing a CFPO (Willard 1912, 1916, 1923, many others; see Anderson 1972). Bent and Willard never published the results of their two months expedition, but Bent discussed his Arizona observations under several species, e.g., uncommon species, such as Gray Hawk (*Asturina nitida*), Common Black Hawk (*Buteogallus anthracinus*) (Bent 1937), and more than a dozen other species in the series. Although a CFPO would have been one of the most unusual Mexican birds Bent and Willard might have seen during their 1922 travels, no mention of having seen the species in Arizona is made under the life history account for the species (Bent 1938).

ORGAN PIPE CACTUS NATIONAL MONUMENT AND PAPAGO INDIAN RESERVATION (TOHONO O'ODHAM NATION)

One of the enigmas in the history of the occurrence of the CFPO in Arizona is the complete lack of early CFPO records from the Altar Valley, Tohono O'odham Nation, and Organ Pipe Cactus National Monument during the U.S.-Mexican boundary Surveys (Appendix C). This is the area in which the CFPO is most commonly found in Arizona and adjacent Sonora, Mexico, today (Flesch 1999, 2003, Flesch and Steidl 2000, 2002, Johnson and Carothers 2003). Starting with Mearns trip in 1894 along the U.S.-Mexican boundary, 17 biologists spent approximately 200 or more person-days on the Papago Indian Reservation (now the Tohono O'odham Nation) between 1894 and 1971. During this period of almost 80 years, only one CFPO was found on the reservation—in 1933—40 years after Mearns had crossed the reservation without find the species (Johnson and Carothers 2003, Johnson et al. 2003). Similarly, ten biologists spent approximately 200 or more person-days in Organ Pipe Cactus National Monument between Mearns' 1894 trip across the monument and 1949, when Hensley found the first CFPO for the Monument (Hensley 1951, 1954, 1959). The 500 person-days spent in ornithological investigations on the reservation and monument do not take into account several hundred days of

work by ornithologist in the Tucson area and between Tucson and the U.S.-Mexican boundary without reporting a CFPO.

Well known ornithologists that worked on the reservation included L. L. Hargrave (Sutton et al. 1941), Loye Miller (Miller 1929), Gale Monson (1934,1936), R. T. Moore (1932, 1937, 1942a, 1942b, 1946, 1947), A. R. Phillips (1932, 1933, Sutton and Phillips 1942), G. M. Sutton (Sutton et al. 1941, Sutton and Phillips 1942), W. P. Taylor (Taylor and Vorhies 1933), A. J. van Rossem (1936), and C. T. Vorhies (Vorhies et al. 1935, Taylor and Vorhies 1933). In addition, several lesser known persons conducted work, e.g., S. C. Bruner (1926) who published a major paper on reservation birds in the Baboquivari Mountains. Finally are those who conducted work in the area without reporting a CFPO, e.g., L. A. Adams, a University of Kansas biologist who published a list of birds studied in June and July, 1906 (Adams 1907) but failed to tell where in the Baboquivari Mountains he actually worked. It is probable that he spent such a long period at Fresnal, the place where out-of-state biologists commonly stayed (Bruner 1926).

Organ Pipe also attracted a list of similarly important ornithologists who found no CFPOs during 55 years of research, from 1894 to 1949 (Appendices A, B). The monument was also smaller and better known, so that locations where studies were conducted are more certain than some of those on the reservation. Reputable ornithologists that studied on the monument included A. B. Howell (Groschupf et al. 1988), who took a CFPO at Fort Lowell in 1916 (Appendix B); L. M. Huey (1942), A. R. Phillips, who took three CFPOs elsewhere (Appendix B); and W. M. Pulich (Phillips and Pulich 1948), W. P. Taylor, and A. J. van Rossem (1936), who named *Glaucidium brasilianum cactorum* (van Rossem 1937).

IMPORTANT EARLY ORNITHOLOGISTS AND COLLECTION SITES

We discuss briefly the professional and amateur ornithologists and collectors who were most instrumental in leaving historical evidence in the way of specimens and/or literature during the five decades after the CFPO was discovered in the U.S. Large numbers of birds and egg sets were collected in southern Arizona for museums during the late 1800s and early 1900s, perhaps as many as 10,000 or more; see discussions under individual collectors, below. This was apparently largely due to both amateur and professional collectors hearing or reading of others' success with finding a species at a given site, such as the CFPO, then visiting that same site to collect CFPOs; see Fort Lowell, below

Some individual ornithologist/collectors collected hundreds or thousands of birds in southern Arizona, especially during the late 1800s. Their collecting trips often traversed hundreds of miles of upland as well as riparian habitats. At least several hundred birds were collected by Stephens in 1881 in a single collecting trip to the Tucson region (Brewster 1882, 1883). Additionally, Stephens made other collecting trips to Arizona. Another early ornithologist, W. E. D. Scott, came from a curatorial position at Princeton College, Plainfield, NJ to spend 1881-1886 working on birds in Pinal, Pima, and Gila Counties, Arizona (Scott 1886). Scott collected 2,500 birds during his stay in Arizona but there is no mention of collecting a CFPO (Scott 1886, Allen 1910, Palmer et al. 1954). Other examples of collectors making trips to Arizona are

discussed under individual accounts, below. Of particular note is H. S. Swarth who, despite numerous trips to Arizona over many years, took only one CFPO specimen (Swarth 1904, 1905, 1914, 1920, 1929).

Major Charles Emil Bendire

The first CFPOs in the U.S. were discovered in 1872 (Coues 1872) by U.S. Army Medical Doctor Charles Bendire along Rillito Creek, near where he was stationed at Fort Lowell, Tucson, Arizona (Allen 1897, Palmer et al. 1954, Hume 1978). He tells specifically of collecting adults and finding young in a nest in mesquites along Rillito Creek.(Bendire 1888, 1892). Bendire also mentioned that "the Elf Owl seems to confine itself in its nesting sites mainly to excavations in giant cactus (Cereus giganteus), so far as known" (Bendire 1892:410); see also, George Breninger, below.

As an army doctor, Bendire traveled extensively throughout southern Arizona. Bendire never recorded a single CFPO in upland habitats or other riparian habitats away from Rillito Creek, either in the vicinity of Picacho Peak, along the Santa Cruz, or otherwise. After he had taken the first CFPO specimen in the U.S., in January, 1872 (Coues 1872, Bendire 1888, 1892), he traveled from Tucson to Picacho Peak and returned (Bendire 1892). Despite his intimate knowledge of the CFPO from his work with the species on Rillito Creek, Bendire failed to record a single CFPO on this journey of approximately 150 miles. Bendire also mentioned various localities traveled along the Santa Cruz River in his writings, both north and south of Tucson. In one publication, Bendire (1895:128) writes "I first met with the Gila Woodpecker . . . in the vicinity of my camp on the Santa Cruz River, a few miles south of Tucson." He also wrote of the Inca Dove, "the only one I obtained was taken in the valley of the Santa Cruz River, near Tubac, Arizona" (Bendire 1892:153).

Frank Stephens

Frank Stephens was one of the more active ornithologists of his day, often collecting large numbers of specimens in Arizona and elsewhere (Abbott 1938, Palmer et al. 1954). In 1881, he traveled to southern Arizona and collected several hundred birds during the late spring and early summer (Brewster 1882, 1883). During 14 days of hunting at Fort Lowell (30 May-4 June and 20-27 June) he collected a single calling CFPO. This was the same locality where Bendire had discovered the species only 10 years earlier (Coues 1872, Bendire 1892. Stephens took large numbers of many species in the Tucson area, e.g., 29 Lucy's Warblers (*Vermivora luciae*), 13 each of the Brown-crested Flycatcher (*Myiarchus tyrannus*), Crissal Thrasher (*Toxostoma crissale*), and Bendire's Thrasher (*T. bendirei*). All 13 of the Brown-crested Flycatcher and five of each of the two thrashers were collected at Fort Lowell; yet, he found only a single CFPO during the entire period (Brewster 1882). Stephens also took another CFPO at Fort Lowell in 1884 (Johnson et al. 2003). The two CFPOs he took there during at least three collecting trips to Fort Lowell (Fischer 2001) demonstrated how uncommon the species actually was; see *Fort Lowell* under *Important Collecting Spots*, below.

Lt. Colonel Edgar A. Mearns

Mearns is of particular interest, not because of finding large numbers of CFPOs but because he is known to have taken only one specimen (Johnson 2003) despite widespread travels throughout central and southern Arizona. On 25 March 1884 Mearns wrote of receiving orders to accompany two cavalry regiments between his station at Fort Verde (now Camp Verde in central Arizona) and Texas. He further wrote "I will have two Ass't Surgeons with me which will make my duties light, and on the 900 miles of horseback riding, that I will have, there will be much leisure and opportunity for zoological and botanical work" (Hume 1978:299). In spite of this long journey through central and southern Arizona and southern New Mexico into west Texas the only CFPO recorded was one taken at or near the Gila River at Casa Grande, 10 May 1885, while traveling from southern Arizona, north toward his post at Fort Verde (Fisher 1893, Johnson et al. 2003).

Mearns also collected specimens of Common Black Hawk and Zone-tailed (*Buteo albonotatus*) Hawk along New and Agua Fria Rivers in central Arizona during at least two collecting trips in March and May 1885 (Mearns 1888, Bendire 1892). CFPOs should have been active during at least one of those trips, and if they were as common as indicated by Fisher at New River in 1892 (Fisher 1893), CFPOs should have been encountered by Mearns. Yet Mearns did not find CFPOs along either lowland river.

From February 1892 to September 1894 Mearns was medical officer and naturalist of the Mexican-United States International Boundary Commission in a survey of the boundary. His journeys took him through the Altar Valley, the Nation, and Organ Pipe (Hume 1978, Fischer 2001) where CFPOs are currently known to occur on both sides of the border (Flesch 1999, Flesch and Steidl 2000, 2002; Flesch 2003, USFWS 2002, RRJ). Mearns planned to publish an exhaustive report on the biology, geology, etc. of the boundary but Congress failed to appropriate the money for its publication (Hume 1978). The only part of Mearns' manuscript that was published was on the mammals (Mearns 1907). The single CFPO, from Casa Grande was Mearns= only CFPO specimen (Johnson et al. 2003).

Herbert Brown

Arizona's first "resident ornithologist" (Huels et al., ms.), Brown came to Tucson in 1873 and remained in Arizona until his death in 1913 (Nelson 1913, Palmer et al.1954). He collected and wrote widely on birds of the Tucson region. His taking of only one CFPO during this period, the only CFPO taken on the Santa Cruz, (Appendix B), is further indication of the species' local and uncommon occurrence. Some of Brown's amazing records during the 1880s included several first records for Arizona from along the Santa Cruz, e.g., an Anhinga on 12 September 1893 (Brown 1906), a species accidental in Arizona (Phillips et al. 1964, Monson and Phillips 1981); a flock of eight Black-bellied Whistling-Ducks (*Dendrocygna autumnalis*) on 5 May 1899 (Brown 1906), a species that by the mid-1900s was still considered "of sporadic and rare occurrence in summer in southeastern and central Arizona" Phillips et al. 1964:11); and a Purple Gallinule (*Porphyrula martinica*) on 10 October 1887, a species still considered casual in the state

(Phillips et al. 1964, Monson and Phillips 1981). Most amazing was a flock of seven or eight Scarlet Ibis (*Eudocemus ruber*) seen at Rillito Creek, near Fort Lowell on 17 September 1890 (Brown 1899), the only record to date for Arizona. He also first discovered the Masked Bobwhite in Arizona and northern Mexico, at that time considered a new species (Brown 1884, 1904; Bendire 1892).

George Breninger

The table in Johnson et al. (2003) shows a long list of skins and eggs by Breninger with the location as Phoenix. Examination of labels with his specimens often mention "woodpecker hole in a cottonwood tree along the Salt River" or a similar entry. Breninger (1898:128) considered the CFPO so common in the Phoenix region that "since trees planted by man have become large enough to afford nesting sites for woodpeckers, this Owl has gradually worked its way from the natural growth of timber bordering the rivers to that bordering the banks of irrigating canals, until now it can be found in places ten miles from the river. I have never known it to use holes in giant cacti as does the little Elf Owl." Breninger's remarks about the occurrence of the CFPO was particularly important since he was not writing about the owl only in the Phoenix area but also mentioned "among the growth of cottonwood that fringes the Gila and Salt rivers of Arizona this Owl is of common occurrence" Breninger (1898:128). He traveled widely throughout southern Arizona, recording the first record of the House Sparrow (Passer domesticus) in Tucson (Breninger 1905) and published papers on the Santa Rita and Huachuca mountains as well as other places in central and southern Arizona (Anderson 1972). The fact that all of his CFPO specimens were from the Phoenix area despite his wide travels further demonstrates the local occurrence of the species. Breninger died in Phoenix, Arizona, on 3 December 1905 from an occupational disease—arsenic poisoning—acquired while using arsenic in preparing museum specimens (Allen 1906, Palmer et al. 1954).

Harry S. Swarth

A suggestion of how uncommon the CFPO was is indicated by the fact that Harry Swarth took only one CFPO during all of his work in southern Arizona, work that extended through four decades and resulted in more than a dozen published papers on the Tucson region. Swarth was one of the most highly trained ornithologists that worked in Arizona. He was associated with four outstanding museums during his professional career—The Field Museum in Chicago; Museum of Vertebrate Zoology, University of California at Berkeley; Museum of History, art and Science, Los Angeles; and California Academy of Sciences, San Francisco (Palmer 1936, Palmer et al. 1954).

Swarth made his first trip to Arizona in 1896, and collected his only CFPO near Tucson (Appendix B). We find this particularly interesting for two reasons, (1) his was the only CFPO specimen collected in the Tucson region between 1884 and 1916, a period of 32 years at the height of bird and egg collecting in Arizona, and (2) Bendire had suggested the trip to him (Fischer 2001) so one would have expected him to take a CFPO from Fort Lowell, where Bendire and others had collected CFPOs and a site of easier access than the Santa Catalina

Mountains. One might surmise that since Stephens found only one CFPO at Fort Lowell in 1881 and one more in 1884 that Swarth failed to find any there in 1896; see *Frank Stephens*, above. During the 1896 trip, Swarth also visited the Huachuca Mountains with three other collectors, on a farm wagon drawn by two horses (Fischer 2001). During this and his next five trips to the state (Fischer 2001) he conducted some of the most thorough early studies of the states avifauna, e.g., a detailed study of the avifauna of the San Xavier mesquite bosque (1905, see above), the most detailed avifauna of the Huachuca Mountains ever published (1904), and the first check-list of Arizona birds (1914). Swarth also spent 29 May-7 July 1917 in Phoenix and vicinity and working up the Salt River to Roosevelt Darn. He mentioned specifically not seeing a CFPO in all that work (Swarth 1920).

M. French Gilman

Gilman left the most complete record of the CFPO in the Gila River region. He made more observations and collected more birds and eggs along the Gila than all other ornithologists combined. There is, however, no mention of the CFPO in his 40 acre breeding bird census at Sacaton, on the bank of the Gila River (Gilman 1915). Furthermore, we find no records of the CFPO from the Gila River after Gilman's work in 1908 (Gilman 1909), nor records of the CFPO from the Salt River (major tributary of the Gila) near Phoenix after the development of large water projects on the two rivers during the early 1900s. Gilman was a government-employed biologist and educator on the Pima Indian Reservation in 1907-1915, teaching at Blackwater, Sacaton, and Santan (Rea 1983, see also Anderson 1972). His papers on "doves, owls, thrashers, and woodpeckers remain the classic contributions to the natural history of Lower Sonoran Desert birds" (Rea 1983:118). They present the most complete story of the avian history of the Gila River before its demise from water projects, especially reclamation projects.

OUTSTANDING COLLECTION LOCALITIES

Fort Lowell

This was the location of the discovery of the CFPO by Bendire as a new bird for the U.S. (Coues 1872, Bendire 1888, 1892). Several CFPO specimens were taken here in following years, undoubtedly by collectors attracted here after hearing of Bendire's original work. Although Bendire collected a male and female CFPO (Bendire 1872) and wrote about CFPO nests, no following ornithologist reported more than a single CFPO at any given time. Originally located in downtown Tucson at Military Plaza, Camp Lowell (later changed to Fort Lowell) was moved out of town approximately 8 or 9 miles east-northeast on Rillito Creek in 1873 (Barnes 1935). Bendire made his camp here in 1872-1873 in anticipation of this move. This also gave him an opportunity to study birds away from the center of town (Bendire 1872). No fewer than nine new species and subspecies of birds were named from the vicinity of Fort Lowell (Brandt 1951, Am. Ornithol. Union 1957). Bendire was instrumental in discovering some of the species new to science, e.g., the Rufous-winged Sparrow and Bendire=s Thrasher, named for him (Coues 1873). Others were found by other collectors, e.g., the Brown-crested Flycatcher, 13 of them collected here in 1881 by Stephens and named as a new subspecies by Brewster (1881). We assume that

the species was earlier overlooked by Bendire, perhaps mistaken for the closely related Ashthroated Flycatcher (*Myiarchus cinerascens*). However, one cannot completely rule out the possibility that this Mexican Species was not at Fort Lowell 10 years earlier, moving into the area from Mexico between 1872 and 1881.

San Xavier Mesquite Forest

Located on the San Xavier Indian Reservation approximately 9-12 miles south of Tucson, this large mesquite forest extended for several miles along the Santa Cruz River. In contrast to Fort Lowell and Rillito, this area is noteworthy because of the lack of CFPO records. In spite of some of the most intensive ornithological work for southern Arizona having been conducted here, the only CFPO ever reported for the Santa Cruz River was collected in or near the mesquite forest by Herbert Brown in 1884 (Johnson et al. 2003, Appendix B). This magnificent forest was bordered by a riparian gallery forest of cottonwoods and other wet riparian trees along the Santa Cruz. It was a favorite site for biologists, botanists as well as ornithologists, and had several accounts published about the plants and birds there during the early 1900s (Swarth 1905, Spalding 1909, Cannon 1911, Willard 1912, Dawson 1921, Arnold 1940, Brandt 1951). The most succinct and readily available ornithological information for the forest is in the form of avifaunal lists, published by Swarth (1905) and Dawson (1921). Swarth worked in the mesquite forest with experienced field assistants, O. W. Howard from 17-23 May 1902 and F. Stephens from 3-13 June 1903. From the resulting 36 person-days of work during the two years, he published his list (Swarth 1905). Dawson' field crew contained four persons that actually conducted the avian work, from 7-26 May and 2-11 June 1917, thus totaling more than 100 person-days of work to prepare skins, eggs, and a list for publication (Dawson 1921). Neither found a single CFPO during all this work. For additional information see Harry S. Swarth, under Collectors, above; and Enigmas, below.

ENIGMAS: THE VERDE AND SANTA CRUZ RIVERS

There are no CFPO records from the Verde River, major tributary of the Salt River despite a large amount of ornithological work having been conducted along the Verde. Major Bendire was stationed at Fort McDowell, on the Verde approximately 7 miles from its confluence with the Salt River (Hume 1978) and Mearns was stationed farther upstream, at Camp Verde, from 25 March 1884 to 1888; see accounts of Bendire and Mearns, above (Palmer 1917, Palmer et al.1954, Hume 1978). Mearns, especially, ranged widely throughout south-central Arizona, visiting localities on the Verde, Agua Fria, and New Rivers (Mearns 1886, Bendire 1892). If the CFPO occurred anywhere along the lower Verde River either or both of these ornithologists should have found it. Furthermore, RRJ, SWC, and co-workers conducted ornithological studies along the Verde from Camp Verde, to its confluence with the Salt River without finding any CFPO (Carothers and Johnson 1971, 1972, 1973; Aitchison et al. 1974, 1975; Carothers et al. 1974). The Verde is similar in size to the Salt and supports an even larger area of cottonwoodmesquite groves than found along the Salt River. Further, the two rivers converge only 2 miles downstream from Blue Point Cottonwoods on the Salt River, where the last three Phoenix area specimens of the CFPO were taken in 1933, 1949, and 1951 (Johnson et al. 2003).

An even greater enigma is that despite the large amount of ornithological research on the Santa Cruz, only one CFPO specimen is known from there, taken in 1884 by H. Brown (Johnson et al. 2003, Huels et al. ms., Appendix B). This seems surprising, especially in view of the fact that some of the rarest birds for the U.S. were found along the Santa Cruz; see Herbert Brown account, above. This included the Gray Hawk, Common Black-Hawk (Buteogallus anthracinus) (Bent 1937), and Rose-throated Becard (Pachyramphus aglaiae). The lack of CFPO records from the Santa Cruz is particularly baffling when considering that most of the Tucson area specimens and early records are from Rillito Creek and tributaries. Rillito Creek is similar in size to and a major tributary of the Santa Cruz. The vegetation and avifaunas that occur along both Rillito Creek and the Santa Cruz are similar. Further, the confluence of the Santa Cruz and Rillito Creek is on the northern outskirts of Tucson and two of the best known collecting localities during the late 1800s and early 1900s were located at equal distances from downtown Tucson: Fort Lowell on Rillito Creek and the San Xavier mesquite forest, each approximately 9 miles from central Tucson; see Outstanding Collecting Localities, above.

RIPARIAN HABITAT USE IN THE CFPO AND OTHER MEXICAN SPECIES

A fatal flaw in the Cactus Ferruginous Pygmy-Owl Recovery Plan and various papers by the USFWS is the lack of attention to riparian habitat while placing too much emphasis on upland and suburban habitats. Nearly all of the upland sites in Recovery Areas north of Tucson have never yielded a single CFPO record; neither has there been any recorded use by an owl of the Interstate I-10 corridor. In contrast, important wet riparian cottonwood-mesquite habitat along upper Rillito Creek is not even included in a Recovery Area. Yet, this is where most of the Tucson specimens and observations for the species were recorded throughout the 1900s and the area where the species was first discovered in the U.S. in 1872 (Coues 1872, Bendire 1892). All specimen and published records from the Gila River region and Phoenix region (Salt and New Rivers, Cave Creek, etc.), north of the Tucson region, are from wet riparian ecosystems (Johnson et al. 2003).

In spite of all this, the Cactus Ferruginous Pygmy-Owl Recovery Team and the USFWS have not fully acknowledged the critical importance of wet riparian habitat to this owl in southern Arizona, especially north of Tucson. This is especially contradictory because of the concern expressed because the "completion of the Huites Dam on the Rio Fuerte, Sinaloa, in 1995 flooded 23,000 acres of tropical deciduous forest (USFWS 2003:3). An estimated loss of 90% or more of Arizona's lowland wet riparian habitat occurred during the first half of the 1900s, flooding riparian ecosystems above dams and dewatering wet riparian ecosystems below dams (Tellman et al. 1997). Although both the Recovery Team and the USFWS have considered xeroriparian ecosystems along desert washes to be important CFPO habitat, they also continue to treat owls in desertscrub as though that is fully suitable habitat when it is marginal habitat at best. Part of the rationale for this treatment has been that this owl is not currently an obligate or

⁵ Remains of a nest of this species were discovered in a large cottonwood tree in 1959 in the San Xavier bosque on the bank of the Santa Cruz River (Phillips et al. 1964, RRJ).

preferential wet riparian species in southern Arizona and to the south, in northern Mexico. This reasoning is severely flawed, as we shall document here.

Even in the tropics, where conditions are warmer and much more humid, the Ferruginous Pygmy-Owl often occurs as an obligate or preferential riparian species. In 1989 the senior author spent 12 days along the Peruvian Amazon and its tributaries studying the Ferruginous Pygmy-Owl. These small owls were found most commonly along many of the large tropical streams (RRJ Field Notes). Of equal interest is that it was never encountered away from a stream, despite walking through several miles of upland habitat on numerous occasions in several localities in the Amazon rainforest. The Ferruginous Pygmy-Owl did occur, however, around human settlements, in clearings adjacent to streamside villages, and in agricultural areas as they reportedly do throughout the American tropics (Alden 1969, Meyer de Schauensee 1970).

The CFPO is one of more than 70 avian species whose distribution barely extends into the southwestern U.S. from Mexico, species that we refer to as Mexican species. The northernmost limits for these species may extend only a few miles north of the border or tens of miles above the border, but none extends more than 200 miles north of the U.S.-Mexican boundary and/or these peripheral breeding populations in the U.S. consist of no more than 200 pairs (our delimiting parameters). At least 35 of these 70 Mexican birds occur in southern Arizona (Appendix A). One of the distinguishing characteristics of many, if not most, of these Mexican species is that they occur as obligate or preferential riparian species at the northern tip of their ranges, in the U.S., but farther south, in Mexico and/or the American tropics commonly occur in much drier habitats.

We shall briefly discuss a few of these species here to illustrate our point. Three of the five species of kingbirds (Tyrannus spp.) that occur in the southwestern U.S. are Mexican species. All three of these species are obligate or preferential wet riparian birds in the U.S. but commonly occupy more arid areas in Mexico. One of these, the Thick-billed Kingbird (T. crassirostris) occurs only in southern Arizona. Couch's Kingbird (T. couchii) occurs only in southern Texas. and the third, Tropical Kingbird (Tyrannus melancholicus), occurs both in Arizona and Texas (Am. Ornithol. Union 1957, 1998; Birds of North America series 1992-2002). In Arizona, the Thick-billed Kingbird is an obligate riparian nesting species, found in riparian gallery forests (Phillips et al. 1964, Oberholser 1974, Rappole and Blacklock 1994, Hubbard 1978) but it breeds in a variety of upland and riparian habitats in Mexico (Howell and Webb 1995, Russell and Monson 1998, Am. Ornithol. Union 1998). In the U.S. (lower Rio Grande Valley), Couch's Kingbird is a preferential riparian nesting species (Oberholser 1974, Rappole and Blacklock 1994) but in Mexico uses both riparian and upland habitats (Howell and Webb 1995, Brush 1999). In both Arizona and Texas, the Tropical Kingbird is a riparian bird (Bent 1942, Phillips et al. 1964, Oberholser 1974, Monson and Phillips 1981, Rappole and Blacklock 1994) but farther south in Mexico uses both riparian and upland habitats (Howell and Webb 1995, Stouffer and Chesser 1998).

Sometimes the demarcation between use of riparian habitat to the north by birds that use other, drier habitats to the south is strongly marked. The switch from drier habitats to wet riparian habitats may happen almost at the border. For example, even in northern Mexico the Thickbilled Kingbird "is not entirely restricted to riparian woodland" (Marshall 1957:86). Or, the switch from drier to riparian habitat may occur north of the border, as in the Common Pauraque (Nyctidromus albicollis) "in far south Texas it is distributed generally over the landscape, but near its northern limits it lives only along tree- and tall-bush-lined rivers (Oberholser 1972:468). The endangered Aplomado Falcon is often considered a bird of open, arid, grassy plains with growths of mesquite, yucca, and cactus (Bailey 1928, Bent 1938, Oberholser 1972). However, more recently it has been noted that the species uses "low, seasonally wet grassland" (Amer Ornithol. Union 1998:109) and "hunts near watering holes along desert streams...riparian woodlands, tidal flats, marshlands, and probably also desert playas" (Keddy-Hector 2000:6).

In light of the plethora of information suggesting that the CFPO, like so many other Mexican birds, is a preferential or obligate riparian species in southern Arizona, it is difficult to discern why the *Cactus Ferruginous Pygmy-Owl Recovery Plan* and the USFWS continue to ignore wet riparian habitat and, instead, treat Sonoran Desertscrub (Brown 1982) as the CFPO's preferred habitat in southern Arizona.

HISTORY LESSONS FROM SOME MEXICAN BIRDS IN ARIZONA

To better understand the development of concepts and misconceptions regarding the early and recent status of the CFPO in Arizona we shall discuss two other species of Mexican birds. The birds we have chosen to illustrate our points are species that extend into the southwestern U.S. from Mexico, reaching only into southern Arizona, and other border states. The first is the Aplomado Falcon, a small falcon that was designated as an endangered species after it had been extirpated in Arizona and the Southwest and for which attempts at reintroduction are currently underway. The second, the Rufous-winged Sparrow, is a species that disappeared from Arizona then reappeared in large numbers without any concerted human effort. A third species that we mention in passing is the Masked Bobwhite, also an endangered species that was extirpated in Arizona and for which attempts at reintroduction have been unsuccessful (USFWS personnel, Buenos Aires NWR, pers. comm.).

The Endangered Aplomado Falcon

Comparisons between the CFPO and Aplomado Falcon are especially appropriate. This is the closest example, geographically and taxonomically, of attempts to aid in the recovery of a small raptor in the southwestern U.S. Both falcon and the owl (1) are federally endangered, (2) are Mexican species, (3) are often considered somewhat common in the southwestern U.S., although the historical record shows otherwise, and (4) have misconceptions about their habitat preferences that could hamper efforts at recovery of the species.

Like the CFPO, the falcon was considered a relatively common bird by many early workers and the most recent authoritative works on Arizona birds consider it was formerly "fairly common"

(Phillips et al. 1964, Monson and Phillips 1981). However, a recently published paper listed only 54 reported falcons for southeastern Arizona and southwestern New Mexico, 17 of them collected between 1850 and 1960, after which the species was considered extinct in the U.S. During the 40 years between 1881 and 1920, at the height of observations and collection of the species, only two were collected in Arizona (a third questionable whether in Arizona or New Mexico) and five observed (Truett 2002). As with the CFPO, these numbers do more than suggest that the Aplomado Falcon was, at best, uncommon. Thus, as with the CFPO, the perception that the Aplomado Falcon was ever common in the U.S. is at complete odds with the historical record. Furthermore, some of the same early ornithologists that were working in southern Arizona without reporting any CFPOs did report and/or collect Aplomado Falcons. This included A. L. Heerman, H. W. Henshaw, R. D. Lusk, and G. Monson⁶ (Truett 2002).

As mentioned earlier, the Aplomado Falcon is almost universally considered a grassland species. However, wet sites, such as water holes along desert streams, riparian woodlands, and marshlands are important hunting sites for the species. (Keddy-Hector 2000:6). Thus, the falcon shares with the CFPO the often overlooked importance of wet ecosystems to the survival of the species.

There is disagreement about the major causes(s) of extirpation of the falcon in the southwestern U.S. Although heavy grazing has often been considered a factor in extirpation of the Falcon (Keddy-Hector 1990, 2000), a recent scientific publication has presented compelling evidence that black-tailed prairie dog (*Cynomys ludovicianus*) control programs were more detrimental to the species than heavy grazing (Truett 2002). Truett's thesis is that the falcon "declined in abundance and disappeared coincident with declines in livestock abundance and the extirpation of prairie dogs (1930s–1940s)" (Truett 2002:379). Truett's studies found that sites in Mexico where the falcon still occurs have a higher prey base than the U.S. sites where the species has been extirpated. He further hypothesizes that heavier grazing in the presence of prairie dogs allows an increase in birds and young prairie dogs, both prey items for the falcon.

The Case of the Disappearing Rufous-winged Sparrow

Like the CFPO, the Rufous-winged Sparrow is considered a permanent resident in southern Arizona. The sparrow was a species new to science, discovered by Bendire in 1872, near Fort Lowell (Phillips et al. 1964, Lowther et al. 1999). It was found regularly in southern Arizona from its discovery into the early 1880s, especially in the Tucson Region. The last record for southern Arizona in the 1800s was a Tucson specimen taken by H. Brown, 7 February 1886 (Phillips et al 1964). There were then no further Arizona records until 1915 when it was recorded in the Coyote Mountains, Pima County (Goldman, USFWS files *in* Phillips et al. 1964). Thus, the sparrow shares at least two features with the CFPO: (1) both species were discovered by Bendire near Fort Lowell in 1872 (Bendire 1888,1892), the sparrow as a species new to science and the owl new to the United States, and (2) the sparrow's absence from southern Arizona for 29 years, from 1886 to 1915, closely paralleled the same period that the CFPO was essentially absent from Arizona (Johnson et al. 2003, Appendix B). There were then few records

⁶ After working in Arizona for 20 years Monson finally reported a CFPO observation (Monson 1955).

until 1929, when the species was considered extinct in Arizona (Swarth 1929), and the American Ornithologists' Union (AOU) checklist stated that it "formerly" occurred in Arizona (AOU 1931). A large invasion of the sparrow from its origins in Mexico in the fall of 1956 resulted in a general increase in the southern Arizona population (Phillips et al. 1964). Today it is so plentiful in the proper habitat that it is encountered on an increasingly frequent basis in the Tucson region. Adults and young feed in suburban Tucson yards, much on the same manner as the CFPO in NW Tucson during the 1990s. Although it has been postulated that heavy grazing led to the species' former demise (Phillips et al. 1964), its recovery from near extinction and even increased expansion of its range occurred without any concerted effort by humans (Phillips 1968a, 1968b).

It seems more than a coincident that the Rufous-winged Sparrow's disappearance from southern Arizona would occur during the same period when the CFPO was also nearly completely absent from the state, being recorded only once in the region, during the 32 years between 1884 and 1916 (Appendix B, Johnson et al. 2003). Numerous papers were published on the impacts of "overgrazing" on the Rufous-winged Sparrow. It was also during this period that the Masked Bobwhite was discovered for the U.S. in southern Arizona by Herbert Brown (Brown 1884, 1885, 1900, 1904). Also a species heavily dependent on grasses, it was extirpated during the early 1900s after decimation of its habitat by heavy grazing (Phillips et al. 1964, Brown 1989). Periods of the sparrow's disappearance from Arizona were correlated with heavy grazing and deterioration of range conditions, producing disastrous results on populations of this sparrow that was so dependent on grassland ecosystems (see Phillips et al. 1964:199). The connection between a secondary cavity nester such as the CFPO, the Rufous-winged Sparrow, and overgrazing is not so apparent since the two species require very different nest sites. The sparrow nests largely in grasslands, often with scattered shrubs and small trees (Lowther et al. 1999), while the owl is dependent on trees large enough for nesting cavities (Proudfoot and Johnson 2000). However, desert grasses often form much of the base of the CFPO food chain, as they do for the sparrow. The diet of CFPO consists largely of insects, reptiles (especially lizards), small mammals, and birds (Proudfoot and Johnson 2000). The dependence of insects on grasses is well known and, in turn, lizards feed largely on insects. Many species of birds and some small mammals feed largely on grass seeds, others feed mostly on insects, while others feed or a combination of insects and grass seeds. Thus, heavy grazing and a reduction in grasses results in a depauperate food base for both the sparrow and the owl. This could be expected to lead to a reduction in owl populations, much in the same way it is credited with leading to reduced Rufous-winged Sparrow populations.

MEXICAN PLANTS AND ANIMALS OCCURRING IN SOUTHERN ARIZONA

The ranges of numerous species of Sonoran Desert plants and animals extend northward from Sonora, Mexico into Arizona. Many of these species= ranges in Arizona end in central Arizona with reduced temperatures, limiting species such as the saguaro and palo verde trees (Cerdicium floridum and C. microphyllum). Here the Sonoran Desert gives way to the central Arizona mountains. However, there are notable exceptions to this general distribution of Sonoran Desert plants and animals with the distance each species extends northward from the U.S.-Mexican

international boundary into Arizona varying for many species. Exceptions to the general distribution of Sonoran Desert plants in Arizona include the following categories:

- 1. Some species extend only a few yards into the U.S., e.g., *Palo zorrillo (Atamisquea emarginata)*, whose only known U.S. populations are in Organ Pipe Cactus National Monument (hereafter, Organ Pipe), at Quitobaquito and Aguajita Springs, immediately adjacent to the international boundary (Turner et al. 1995, RRJ).
- 2. Other species extend somewhat farther north, e.g., Limber bush (Jatropha cinerea) in Senita Basin and Hinds nightshade (Solanum hindsianum), both in Organ Pipe, a few miles north of the international boundary (Turner et al. 1995) or the Rose-throated Becard (Pachyramphus aglaiae) and Five-striped Sparrow (Aimophila quinquestriata), both breeding near Patagonia in extreme southeastern Arizona (Monson and Phillips 1981, Groschupf 1992).
- 3. The third category of plants and animals extend as far north as the Tucson area. This includes plants (Turner et al. 1995), e.g., palo blanco (Lysiloma watsoni), yellow trumpet bush (Tecoma stans), and organ pipe cactus (Stenocereus thurberi) and birds, e.g., Arizona Woodpecker (Picoides arizonae) (Johnson et al. 1999), Tropical Kingbird (Tyrannus melancholicus) (Stouffer and Chesser 1998), and Rufous-winged Sparrow (Lowther et al.).
- 4. The fourth categories of plants and animals with distributions truncated south of the northern limits of the Sonoran Desert occur as far north as the Phoenix area.
- 5. Climatic factors important to growth of certain plants and animals, including the CFPO, are clearly more marginal at the northern extreme of the Sonoran Desert, in southern and central Arizona. In Arizona, moisture and temperature regimes limit growth of several species such as giant bursage (Ambrosia ambrosiodes), Palo zorrillo (Atamisquea emarginata), several species of Acacia (Acacia spp.) and other closely related legumes, allowing them to grow only along desert watercourses. In contrast, while these species occur only as obligate or preferential xeroriparian species in Arizona, farther south in Mexico these same species are common components of drier upland desertscrub plant communities.

An examination of factors involved in plant biogeography allows us to extrapolate to animal distributions. Animals may migrate, move uphill or downhill (either in feet or miles), hibernate, burrow, move from upland into riparian situations during hot, dry periods, and otherwise escape inclement conditions. Plants, however, are more directly influenced by local conditions because of their inability to move and thus are the ultimate biological indicators of local environmental factors. Thus, as supplemental information regarding limiting factors influencing the CFPOs distribution, we here examine a few examples of perennial plant species that have distributional ranges whose northern extremes end a few miles north of the international border with Mexico

(Kearney and Peebles 1960, Shreve and Wiggins 1964, Benson and Darrow 1981, Benson 1982, Turner et al. 1995):

- (a) Palo zorrillo (Atamisquea emarginata): In Organ Pipe NM, at Quitobaquito and Aguajita.
- (b) Night blooming cereus (Peniocereus striatus): In Organ Pipe NM and the Nation.
- (c) Senita cactus (Lophocereus schottii): In Organ Pipe NM and Cabeza Prieta Wildlife Refuge.
- (d) Limber bush (Jatropha cinerea): In Organ Pipe NM.
- (e) Hinds nightshade (Solanum hindsianum): In Organ Pipe NM.
- (f) Sweet acacia (Acacia farnesiana): On the Nation and near Ruby.

Additionally, several Mexican plant species extend farther north in Arizona, but have a spotty, disjunct distribution, in the same manner as the CFPO. Elephant tree (Bursera microphylla) grows as far north as west-central Arizona but "is rare to locally common in washes...but typically grows in the warmest microhabitats, often south-facing slopes of low desert mountain ranges" (Turner et al. 1995:127). Some Mexican plants occur in only one disjunct locality in Arizona, sometimes a considerable distance from the international boundary. Palo blanco (Lysiloma watsoni), a common plant in Sinaloan thornscrub of Mexico (Shreve 1951, Shreve and Wiggins 1964, Brown 1982, Turner et al 1995), in Arizona "grows only in south-facing canyons of the Rincon Mountains, Pima County, between 1,025 and 1,465 m [3,350 to 4,800 ft]" (Turner et al. 1995:265). Some plant species are limited in distribution by a temperature/moisture combination. Chicurilla (Ambrosia cordifolia), another plant that extends into southern Arizona from Mexico, is a common perennial along washes in Organ Pipe NM and has a limited, disjunct distribution on scattered mountain ranges in s. Arizona. Still others are limited by temperature and the absence of frost; A. cordifolia can grow in response to winter rains (Turner et al. 1995:81).

SUMMARY AND CONCLUSIONS

A time honored principle in ornithology—simply stated—holds that "the farther north you go the fewer southern-birds there are." This applies to both species and numbers of individuals within a given "southern species." At first this may sound tautologous (repetitive) or redundant. However, it is logical when one considers that birds from the tropics and subtropics generally reach a northernmost point beyond which environmental conditions are not conducive to the species existence. This is true for nearly all of the more than 70 avian "Mexican species" whose distribution barely extends into the southwestern U.S. from Mexico. Many of these Mexican species have populations whose known numbers in the U.S. are no more than 100 breeding pairs, sometimes much fewer (Birds of North America series). Thus, species such as the Buff-collared Nightjar (Caprimulgus ridgwayi) (Bowers and Dunning 1997), Black-Capped Gnatcatcher (Polioptila nigriceps), and Five-striped Sparrow (A. quinquestriata) (Groschupf 1992) are among a large number of "southern-birds" whose numbers in the U.S. are never expected to be in the hundreds or thousands.

We have discussed and given several examples of many Mexican species that show a decided preference for riparian habitats in the U.S. regardless of their habitat preferences farther south. In some cases habitat selection changes as a species progresses northward, even within the U.S., such as with the Common Pauraque, whose habitat selection changes from the general landscape in southern Texas so that at "its northern limits it lives only along tree- and tall-bush-lined rivers (Oberholser 1972:468); see also discussion above, under Riparian Habitat Use in the CFPO and Other Mexican Species.

The CFPO is no exception to these factors. Specimen records since the species was discovered in Arizona in 1872 show large gaps when no CFPOs were found in either the Phoenix, Gila River, or Tucson regions (see Appendix B). Under these conditions, it is unreasonable to expect there to ever be a large, stable CFPO population in Arizona regardless of political policies and management practices. Our analysis suggests that the only way to have any continuing population of the CFPO in Arizona is through the establishment of wet riparian reserves that would benefit both the CFPO and other wet riparian species.

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APPENDIX A

The following neotropical birds have ranges extending northward into southern Arizona from Mexico. Distribution and habitats are from Bent (1919-1968), Phillips et al. (1964), Monson and Phillips (1981), Howell and Webb (1995), Russell and Monson (1998), Am. Ornithol. Union (1998) and Birds of North America series (1992-2003). In the following table, R=Preferential or Obligate Riparian (including xeroriparian of desert washes); U=Upland.

	Preferred Breeding Habitat		
Species	Madrean Woodland	Lowland	
. Gray Hawk (Buteo nitidus)		R	
. Aplomado Falcon (Falco femoralis)		U	
Northern (Masked) Bobwhite (Colinus virginianus ridge	vayi)²	U	
. Montezuma Quail (Cyrtonyx montezumae)	· · · · · · · · · · · · · · · · · · ·		
Thick-billed Parrot (Rhynchopsitta pachyrhyncha)	×		
Whiskered Screech Owl (Otus tricopsis)	X		
Whiskered Screech Owl (Olas incopsis)		R	
Ferruginous Pygmy-Owl (Glaucidium brasilianum) ⁴		R	
Buff-collared Nightjar (Caprimulgus Ridgwayi)		R	
Broad-billed Hummingbird (Cynanthus latirostris)	X		
. White-eared Hummingbird (Hylocharis leucotis) ⁵			
. Berylline Hummingbird (Amazilia beryllina) ⁵			
. Violet-crowned Hummingbird (A. violiceps)	×		
3. Blue-throated Hummingbird (Lampornis clemenciae)	X		
Magnificient Hummingbird (Eugenes fulgens)	X		
5. Elegant Trogon (Trogon elegans)			
5. Eared Trogon (Euptilotis neoxenus)		R	
7 Green Kingfisher (Chlorocyle americana)	Х		
a Arizona Whodnecker (<i>Picoides arizonae</i>)		R	
Northern Beardless-Tyrannulet (Camptostorna imbero	e) X	• • •	
Ruff-breasted Flycatcher (Empidonax fulviffons)	^		
Dusky-capped Flycatcher (Mylarchus tubercullier)	X X		
2 Sulphur-bellied Flycatcher (Mylodynastes lutelveritis)	^	R	
3 Tropical Kingbird (Tyrannus melancholicus)		R	
A Thick-hitted Kinghird (T. crassirostris)		R	
5. Rose-throated Becard (Pachyramphus aglaiae)		Ü	
6. Chihuahuan Raven (Corvus cryptoleucus)⁵		Ü	
7 Mexican Chicadee (Parus sciateri)	X	1.6	
8. Black-capped Gnatcatcher (Polioptila nigriceps) ⁵		U	
9. Pyrrhuloxia (Cardinalis sinuatus)		R&U	
Varied Bunting (Passerina versicolor)		R&U	
1. Botteri's Sparrow (Aimophila botterii)		U	
2. Cassin's Sparrow (A. cassinii) ⁵		U	
3. Rufous-winged Sparrow (A. carpalis)		U	
4. Five-striped Sparrow (A. quinquestriata) ⁵		Ú	
Yellow-eyed Junco (Junco phaeonotus)	X		

Extirpated by early 1900s; few if any substantiated recent records (Phillips et al. 1964)

⁶ Also occurs in Great Plains but no farther north in Arizona

Extirpated by early 1900s; reintroduced with little success (Monson and Phillips 1981)
Extirpated by early 1900s; originally occurred N. from Mexico in flight years (Monson and Phillips 1981); recent introductions with little success (Snyder et al. 1999, Kunzmann et al., ms)

Formerly north to New River and the Salt River, now only in southern Arizona (Millsap and Johnson 1988, Proudfoot and Johnson 2000, Johnson et al. 2000)

Saro and to all.

Rare and local, perhaps breeding some years and not others (Monson and Phillips 1981)

Preferential xeroriparian nesting species (Johnson et al. 1977, 1987)

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APPENDIX B

SPECIMENS AND WRITTEN RECORDS FOR THE CACTUS FERRUGINOUS PYGMY-OWL (Glaucidium brasilianum cactorum) FOR CENTRAL AND SOUTHERN ARIZONA: The First Hundred Years (1872-1971) (Showing Gaps in the Record)

Cactus Ferruginous Pygmy-Owl records for Arizona, by region, for 100 years after its discovery in Arizona, including museum specimens (skins and eggs), published records, and authenticated file records from 1872 to 1971, in chronological order. Records separated by 3 or more years are clumped. Museums where specimens are found are designated by the following acronyms: ARIZ (University of Arizona Bird Collection); CAS (California Academy of Science); CU (Cornell University); FMNH (Field Museum of Natural History); MCZ (Museum of Comparative Zoology, Harvard University); MVZ (Museum of Vertebrate Zoology, University of California, Berkeley); SBCM (San Bernardino County Museum); UCLA (University of California at Los Angeles); UCM (University of Colorado Museum of Natural History); UF (Florida Museum of Natural History, University of Florida); UMMZ (University of Michigan Museum of Zoology); USNM (U.S. National Museum, Washington D.C.; WFVZ (Western Foundation of Vertebrate Zoology).

Date	Location (County)	Specimen (Museum)	Type of Record	Source (Collector or Reference)
		UCSON REGION		
24 Jan 1872	Fort Lowell (Pima Co.)	Skin (USNM)		(Coues 1872; Bendire 1888, 1892)
Spring & Summer 1872	Fort Lowell (Pima Co.)	?		(Bendire 1888, 1892)
Julimes 1012		(8-YEAR GAP)		
1881-1886	Tucson (Pima Co)		Observations	(Scott 1886)
3 Jun 1881	Fort Lowell (Pima Co.)	Skin (MCZ)		F. Stephens (Brewster 1883)
18 Apr 1884	Tucson (Pima Co)	Skin (USNM)	1,000	E. W. Nelson
26 May 1884	Fort Lowell (Pima Co.)	Skin (CAS)		F. Stephens
23 Nov 1884	Santa Cruz River, S. of Tucson (Pima Co.)	Skin (MCZ)		H. Brown (Huels et al., ms.)
		(11-YEAR GAP)		
13 Apr 1896	Santa Catalina Mtns., near Tucson (Pima Co.)	Skin (CAS)		H. S. Swarth
		(19-YEAR GAP)		and a summer of the second discount of the second
29 Jan 1916	Fort Lowell (Pima Co.)	Skin (UCLA)		A. B. Howell (1916)
9 May 1918	Santa Catalina Mtns., near Tucson (Pima Co.)	?		H. H. Kimball (1921)
4 Mar 1920	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)	2 skins (UMMZ)		H. H. Kimball
20 Nov 1920	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)	Skin (FMNH)	:	H. H. Kimball
15 Apr 1922	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)	Skin (UMMZ)		H. H. Kimball

Date	Location (County)	Specimen (Museum)	Type of Record	Source (Collector or Reference)
22 Jul 1922	Tucson (Pima Co.)	Skin (UMMZ)		H. H. Kimball
19 Aug 1922	Tucson (Pima Co.)	Skin (FMNH)		H. H. Kimball
23 Aug 1922	Tucson (Pima Co.)	Skin (FMNH)		H. H. Kimball
23 Aug 1322 1	1000011 (2700 00-1	(9-YEAR GAP)	1	
24 Dec 1932	Rillito Valley, Tucson (Pima Co.)		CBC record	A. H. Anderson (1933)
18-YEAR G	(See this period for ORGA	N PIPE/NATION RE	GION and PHOE	NIX REGION)
3 Dec 1941	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)		ARIZ files	F. Thornburg
21 Dec 1941	Santa Catalina (Pima Co.)		CBC record	(W. X. Foerster 1942)
9 Apr 1943	Esperero Canyon, Santa Catalina Mtns. (Pima Co.)		ARIZ files	F. Thornburg
19 Dec 1943	Santa Catalina (Pima Co.)		CBC record	(W. X. Foerster 1944)
12 Apr 1945	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)	The state of the s	ARIZ files	F. Thornburg
6 Jan 1948	Catalina Foothills Estates, Santa Catalina Mtns. (Pima Co.)	Skin (DEL)		A. R. Phillips
4 Mar 1949	Ventana Canyon, Santa Catalina Mtns. (Pima Co.)		ARIZ files	F. Thornburg
4 & 15 Mar 1949	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)	\$	ARIZ files	F, Thornburg
12 A pr 1950	Catalina Foothills Estates, Santa Catalina Mtns. (Pima Co.)		Observation	Brandt (1951)
11 Mar 1951	Esperero Canyon, Santa Catalina Mtns. (Pima Co.)		ARIZ files	J. T. Marshall
22 Apr 1952	Tucson Mtns. (Pima Co.)		ARIZ files	F. Thornburg
5 Jan 1953	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)	Skin (ARIZ)	and the second s	J. T. Marshall
7 Apr & 7 May 1953	Tucson Mtns. (Pima Co.)		ARIZ files	F. Thomburg
		(4-YEAR GAP)		
7 May 1958	Canyon del Oro, Tucson (Pima Co.)		ARIZ files	F. Thornburg
,		(4-YEAR GAP)		
13 Apr 1963	Catalina Foothills Estates, Santa Catalina Mtns. (Pima		Observation	J. T. Marshall (pers. comm.)
	<u>Co.</u>)	(5-YEAR GAP)	k	The state of the s
8 May 1969	Catalina Foothills Estates, Santa Catalina Mtns. (Pima Co.)		ARIZ files	D. W. Lamm
22 Mar 1971	Catalina Foothills Estates, Santa Catalina Mtns. (Pima Co.)		ARIZ files	D. W. Lamm
Summer 1971	Tucson (Pima Co.)		Observation	Snider (1971)
Summer 1971	Sabino Canyon, Santa Catalina Mtns. (Pima Co.)		Observation	Snider (1971)

	Location (County)	Specimen (Museum)	Type of Record	Source (Collector or Reference)
Date		A RIVER REGION		1000
18-21 Aug 1876	Old Camp Goodwin, 1.5 km. w. of Geronimo (Graham Co.)	Observation		(Aiken 1937)
		(8-YEAR GAP)		the state of the s
10 May 1885	Casa Grande (Pinal Co.)	Skin (AMNH)		E. A. Mearns (Fisher 1893)
		(10-YEAR GAP)		a complete symmetric description and accomplete propagation of the following propagation of the second
25 Mar 1896	Agua Caliente, west of Gila Bend (Maricopa Co.)	Skin (CAS)		W. B. Judson
		(11-YEAR GAP)		
25 Jan 1908	Blackwater, near Casa Grande (Pinal Co.)	Skin (SBCM)		M. F. Gilman (Rea 1983)
28 Mar 1908	Blackwater, near Casa Grande (Pinal Co.)	Skin (SBCM)		M. F. Gilman (Rea 1983)
10 May 1908	Sacaton, near Casa Grande (Pinal Co.)	Eggs (SBCM)	The second of th	M. F. Gilman
1908-1909	Agua Catiente, west of Gila Bend (Maricopa Co.)	Bird and egg		M. F. Gilman (1909)
	PHOEN	IX/SALT RIVER REGIC	Negetee	The contract of the contract o
17 Jun 1892	New River (Maricopa Co.)	2 skins (USNM)		A. K. Fisher (1893)
12 Apr 1895	Cave Creek (Maricopa Co.)	Skin, eggs (USNM)		R. D. Lusk
13 Apr 1895	Phoenix (Maricopa Co.)	Eggs (FMNH)		R. A. Campbell
5 May 1896	Phoenix (Maricopa Co.)	Skin (MCZ), eggs (FMNH)		G. F. Breninger
19 Feb 1897	Phoenix (Maricopa Co.)	Skin (CU)		G. F. Breninger
3 Apr 1897	Phoenix (Maricopa Co.)	Eggs (ARIZ)		F. W. Bennett
22 Apr 1897	Phoenix (Maricopa Co.)	Skin (MCZ), 2 egg sets (WFVZ)		G. F. Breninger
30 Jul 1897	Phoenix (Maricopa Co.)	Skín (FMNH)		G. F. Breninger
14 Nov 1897	Phoenix (Maricopa Co.)	Skin (UCM)		G. F. Breninger
25 Jan 1898	Phoenix (Maricopa Co.)	Skin (UCM)		G. F. Breninger
19 Feb 1898	Phoenix (Maricopa Co.)	Skin (MCZ),		G. F. Breninger
20 Apr 1898	Phoenix (Maricopa Co.)	Eggs (WFVZ)		G. F. Breninger
May 1898	Phoenix (Maricopa Co.)	Eggs (WFVZ)		G. F. Breninger
18 May 1898	Phoenix (Maricopa Co.)	Eggs (MVZ)		G. F. Breninger
13 Dec 1898	Phoenix (Maricopa Co.)	Skin (UCM)	finale to the second se	G. F. Breninger
18 Jan 1899	Phoenix (Maricopa Co.)	Skin (MCZ)	<u>.</u>	G. F. Breninger
10 0an 1000	\$	(5-YEAR GAP)	1	
3 Mar 1905	Phoenix (Maricopa Co.)	Skin (FMNH) (27-YEAR GAP)		G. F. Breninger
8 Mar 1933	Salt River, Blue Point Cottonwoods (Maricopa Co.	Skin (MNA)	april 1 de la constante de la	L. L. Hargrave
IAE V	EAR GAP) (See this period for the control of the co	ORGAN PIPE-NATION	REGION and	TUCSON REGION)
(15-1 24 Sep 1949	Salt River, Blue Point Cottonwoods (Maricopa Co.	Skin (DEL)		A. R. Phillips

Date	Location (County)	Specimen (Museum)	Type of Record	Source (Collector o Reference)
30 Jun 1951	Salt River, Blue Point Cottonwoods (Maricopa Co.)	Skin (DEL)		A, R. Phillips
		19-YEAR GAP)		
14 May 1971	Salt River, Blue Point Cottonwoods (Maricopa Co.)		Observation	R. R. Johnson and others
	ORGAN	PIPE-NATION REG	ION	the Salaran Constitution
Jan 1933	Fresnal Canyon, Baboquivari Mtns. (Pima Co.)	Skin (MVZ)	AL ALAMAN AND AND AND AND AND AND AND AND AND A	R. T. Moore
	(15-YEAR GAP) (See this period	for PHOENIX REG	ION and TUCSON	NREGION)
6 Jun 1949	Residential area, Organ Pipe Cactus Nat=I Mon., (Pima Co.)	and the second s	Organ Pipe files	Hensley (1951)
28 Jul 1949	Alamo Canyon, Ajo Mtns., Organ Pipe Cactus Nat=I Mon (Pima Co.))	Organ Pipe files	Hensley (1954)
		(5-YEAR GAP)		**************************************
10 Apr 1955	Cabeza Prieta Tank, Cabeza Prieta Wildlife Refuge (Yuma Co.)		Observation	Monson (1955)
and the		11-YEAR GAP)	- 1000000000000000000000000000000000000	pro-pro-
20 Oct 1967	Organ Pipe Cactus Nat=I Mon., (Pima Co.)	;	Organ Pipe files	R. Cunningham
20 Jun 1968	Organ Pipe Cactus Nat=I Mon., (Pima Co.)		Organ Pipe files	R. Cunningham
Apr-Sep 1969	Organ Pipe Cactus Nat=I Mon., (Pima Co.)		Organ Pipe files	Cunningham (Snider 1970)
16 Jun 1969	Organ Pipe Cactus Nat=l Mon., (Pima Co.)		Organ Pipe files	R. Cunningham

APPENDIX B REFERENCES

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APPENDIX C

EXPEDITIONS TO SOUTHERN ARIZONA DURING THE 1800S THAT REPORTED ON BIRDS BUT DID NOT COLLECT A CACTUS FERRUGINOUS PYGMY-OWL

Much of the travel of the expeditions listed in Table C-1, below, was across upland Sonoran Desertscrub. Thus the premise that the earlier populations of CFPOs were not found in upland situations because naturalists did not visit these areas is inaccurate.

Table C-1. Expeditions to southern Arizona during the 1800s that reported on birds but did not collect a Cactus Ferruginous Pygmy-Owl, except for Mearns (after Fischer 2001, Johnson et al. 2003).

Name and Reference	Date	Type of Expedition and Route Traveled
John W. Audubon (1906) [son of John J. Audubon]	1849-1850	Private; From Mexico into southern Arizona, up the W side of the Baboquivari Mtns., north through current Tohono O'odham lands to the Pima villages near Phoenix.
W. H. Emory (1848)	1848	Military reconnaissance along Gila River in Arizona.
S. F Baird (1859)	1849-1856	U.SMexican Boundary Survey; boundary between Arizona and Sonora, including localities where CFPOs occur today—Organ Pipe, Tohono O'odham, Altar Valley
A. L. Heerman (1859)	1854	Parke railroad survey; From the Gila River down past Picacho Peak to Tucson, then east to the San Pedro River, and Rio Grande River at El Paso.
H. H. Henshaw (1875a, 1875b)	1874	Geog. And Geol. Explor. And Surv. W. of the 100 th Merid.ian; visited Cienega SE of Tucson and spent several weeks at Fort Lowell.
C. E. H. Aiken (1937)	1876	Private; From Colorado Spr. S through NM and W to Camp Goodwin on the Gila R., near present day Fort Thomas (Palmer et al. 1954).
C. E. Bendire (1892)	April, 1872	Military reconnaissance from Bendire's station at Fort Lowell to Picacho Peak and return. He collected a lowland nesting Spotted Owl (Strix occidentalis)–1 of two lowland nesting records for Arizona (Phillips et al. 1964) but recorded no CFPOs; see text.
E, A. Meams	1884-1885	Military reconnaissance from his station at Fort Verde, 900 miles to West Texas. The only CFPO recorded on this trip was one collected at Casa Grande, apparently of the Gila R., 10 May 1885 (Fisher 1893, Hume 1978, Johnson et al. 2003).
E. A. Meams (1907)	1894	U.SMexican Boundary Survey; boundary between Arizona and Sonora, including localities where CFPOs occur today—Organ Pipe, Tohono O'odham, Altar Valley

Picacho Pass was the early site of a stage station (Barnes 1988) on the Great Southern Mail road that passed through the pass. Thus, early biologists, such as U.S. Army medical doctors Charles Bendire and Edgar Mearns, would follow the stage coach line when traveling between Tucson and Picacho or northward toward Phoenix (Hume 1978, Barnes 1988). Thus, if the CFPO had inhabited upland desertscrub and xeroriparian habitats at that time it should have been detected

in these habitats along this route during these, numerous cross-country expeditions by some of the country's leading biologists.

We here give examples of two of these trips. During 1884 and 1885 Mearns traveled from his post at Fort Verde, 900 miles to West Texas and return (Humes 1978). While traveling from southern Arizona, north toward his post at Fort Verde, Mearns collected a CFPO near the Gila River at Casa Grande, on 10 May 1885 (Fisher 1893), he left no other records of the CFPO on this long trip through southern and central Arizona. Mearns also traveled extensively in the mountains near Fort Verde and along the rivers that drained toward the south. He wrote of experiences with hawks that were new to him: the Common Black Hawk (Buteogallus anthracinus) and Zone-tailed Hawk (Buteo albonotatus) along the Agua Fria and New Rivers in 1885 (Mearns 1886, Bendire 1892). It is particularly noteworthy that although Mearns recorded no CFPOs at New River in 1885 only 7 year later, in 1892, Fisher collected two CFPOs at New River (Fisher 1893). This suggests that those that Fisher found there were either in a very local, easily overlooked situation, that the species may have moved into the New River area after Mearns was there in 1885, or both.

A similar example of a long, cross-country trip without record of a CFPO was in April 1872. After Bendire had taken the first CFPO specimen for the U.S., in January of that year (Coues 1872, Bendire 1888, 1892), he traveled from Tucson to Picacho Peak and returned (Bendire 1892). Despite his intimate knowledge of the CFPO from his work with the species on Rillito Creek, Bendire failed to record a single CFPO on this journey of approximately 150 miles. Bendire's ornithological ability led to his collecting a nesting Spotted Owl (Strix occidentalis), 10 mi. northwest of Tucson—one of only two lowland nesting records for Arizona (Phillips et al. 1964)—for the Spotted Owl usually nests in higher montane pine forests (Phillips et al. 1964, Monson and Phillips 1981). Further, Bendire never recorded a single CFPO in uplands habitats away from Rillito Creek, either in the vicinity of Picacho Peak or otherwise, on this or any other trip (Bendire 1872). Thus, the question remains: if CFPOs historically occurred in any habitats except those in wet riparian ecosystems, why were they not recorded during field explorations by biologists during the late 1800s and early 1900s in southern and central Arizona.

In addition to these expeditions of the late 1800s there were a large number of ornithological investigations conducted in Arizona, mostly southern Arizona but some in central Arizona. During the early 1900s dozens of papers were published on studies conducted by ornithologists that did not find CFPOs. For example, starting with Mearns trip in 1894 along the U.S.-Mexican boundary, 17 biologists spent approximately 200 or more person-days on the Papago Indian Reservation (now the Tohono O'odham Nation) between 1894 and 1971. During this period of almost 80 years, only one CFPO was found on the reservation, in 1933, 40 years after Mearns had crossed the reservation without finding the species (Johnson and Carothers 2003, Johnson et al. 2003). Similarly, 10 biologists spent approximately 300 or more person-days in Organ Pipe Cactus National Monument between Mearns' 1894 trip across the monument and 1948, when Hensley found the first CFPO for the Monument (Hensley 1951, 1954, 1959). The 500 person-days spent in ornithological investigations on the reservation and monument do not take into account several hundred days of work by ornithologist in the Tucson area without reporting a

CFPO. For example, in 1917, a field crew of four persons from the Santa Barbara Museum in California worked 7-26 May and 2-11 June, thus totaling more than 100 person-days of work in preparation or skins, eggs, and a list of birds for publication (Dawson 1921). The Santa Barbara crew found no CFPO. Other studies for the Tucson area that had results that were published in papers with the CFPO prominently missing included those by Swarth (1905), Willard (1912), Monson and Phillips 1941, Monson (1942), and dozens of others.

Some of the nation's leading ornithologists traveled to southern Arizona from some of the best known scientific institutions, especially to study Mexican species and other Sonoran Desert species that were poorly known at that time. Well known ornithologists that worked on the reservation included L. L. Hargrave (Sutton et al. 1941), Loye Miller (Miller 1929), Gale Monson (1934,1936), R. T. Moore (1932, 1937, 1942a, 1942b, 1946, 1947), A. R. Phillips (1932, 1933, Sutton and Phillips 1942), G. M. Sutton et al. 1941, Sutton and Phillips 1942), W. P. Taylor (Taylor and Vorhies 1933), A. J. van Rossem (1936), and C. T. Vorhies (Vorhies et al. 1935,

Taylor and Vorhies 1933). In addition, several lesser known persons conducted work, e.g., S. C. Bruner (1926), who published a major paper on reservation birds in the Baboquivari Mountains. Finally, are those who conducted work in the area without reporting a CFPO, e.g., L. A. Adams, a University of Kansas biologist who published a list of birds studied in June and July, 1906 (Adams 1907), but failed to tell where in the Baboquivari Mountains he actually worked. It is probable that he spend such a long period at Fresnal, the place that out-of-state biologists commonly stayed, but we shall never know for sure about this and certain other studies.

The monument drew a list of similarly important ornithologists and was smaller and better known so that locations where studies were conducted are more certain than that of Adams, whether on the reservation or not. Reputable ornithologists that studied there included A. B. Howell (Groschupf et al. 1988), L. M. Huey (1942), A. R. Phillips and W. M. Pulich (Phillips and Pulich 1948), W. P. Taylor, and A. J. van Rossem (1936).

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U.S. Fish and Wildlife Service White Paper: Significance of the Western Population(s) of the Cactus Ferruginous Pygmy-Owl

(December 2, 2003)



by

R. Roy Johnson and Steven W. Carothers



U.S. Fish and Wildlife Service White Paper Significance of the Western Population(s) of the Cactus Ferruginous Pygmy-Owl (December 2, 2003)

A REVIEW AND REBUTTAL

by

R. Roy Johnson, PhD¹ and Steven W. Carothers, PhD² June 22, 2005

INTRODUCTION

In December of 2003 the United States Fish and Wildlife Service (Service; USFWS in citations) released a white paper document (USFWS 2003a) concerning the status of the Arizona population of the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), hereafter referred to as CFPO. This white paper was apparently written by staff in the Service's Tucson Field Office. It is our understanding that this paper has been submitted to the Service's Regional Director, Mr. Dale Hall (Region 2).

The introduction of the white paper describes the document's purpose:

This paper explores the significance of the cactus ferruginous pygmy-owl distinct population segment (DPS) as listed under the Endangered Species Act to the taxon as a whole. This is done by a progressive assessment of potential significance issues starting with the significance of the Arizona DPS to the Sonoran Desert Biome, then to the Western Population, and finally to the taxon as a whole.... The purpose of the paper is to assist the FWS in addressing the 9th Circuit Court of Appeals ruling which found that the Fish and Wildlife Service (FWS) was "arbitrary and capricious" in its determination to list the Arizona portion of the subspecies' range as an endangered DPS. Specifically, the 9th Circuit found that the "significance" portion of the DPS determination was insufficient. Both the District and Appellate courts deferred to the FWS' DPS policy and upheld the Service's finding of discreteness (USFWS 2003a:1).

The 9th Circuit Court finding referred to in this paragraph occurred in 2003 as a result of a legal challenge to the Service's designation of the Arizona CFPO as an endangered Distinct Population Segment (DPS) in 1997 (USFWS 1997). The white paper represents an attempt by biologists in the Service's Tucson Office to provide new and relevant information that supports their opinion that the Arizona population of CFPO is not only discrete but "significant" to the taxon (the subspecies as a whole), thereby justifying its designation as a DPS.

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The white paper raises a number of biological issues that are subject to alternate interpretation from that reached by its authors. In the following pages we review the white paper, present these alternate interpretations, and attempt to clarify issues concerning the preferred habitat of the CFPO and its historic, current, and future potential range in Arizona. These issues are relevant to understanding whether or not the Arizona population of fewer than 30 known or suspected breeding CFPOs is biologically significant according to the Service policy recognizing distinct vertebrate population segments (61 FR 4722).

We have based our findings on the best available scientific information on the CFPO, including our personal knowledge of the species and its habitat. We are thoroughly familiar with the published literature on this species, including the portion of the subspecies in Arizona that has been designated a DPS. Between the two of us we have studied the bird in the field for over 75 years and published a number of papers on the biology and status of the species in Arizona and elsewhere (see Johnson and Simpson 1971, Johnson et al. 1977, Johnson and Haight 1984, Johnson et al. 1987, Millsap and Johnson 1988, Johnson et al. 2000, Proudfoot and Johnson 2000, Johnson et al. 2003, Johnson and Carothers 2003, Johnson et al. 2004). One of us (RRJ) has also participated as a technical member of the Service's CFPO recovery team (1998—present), and we are both knowledgeable about the Endangered Species Act, as amended, as well as Service policies regarding Distinct Population Segments.

The Service's Distinct Population Segment Policy

In 1978, the United States Congress amended the Endangered Species Act (ESA) to allow for the listing of distinct population segments of vertebrate animals, and at the time directed the Service and National Marine Fisheries Service (NMFS) to use the DPS listing authority "sparingly and only when the *biological evidence* [our emphasis] indicates that such action is warranted" (Senate Report 151, 96th Congress, 1st Session). The current policy regarding the recognition of distinct vertebrate population segments under the ESA (61 FR 4722) was adopted as a Final Rule by the Service and NMFS in 1996. The policy uses a two-part analysis to determine the appropriateness of the DPS distinction. First, the Service must establish that the subject population is discrete, and second that this population is significant.

Discreteness. The test for discreteness requires meeting one of two disjunctive criteria, including: 1) The population is markedly separated from other populations of the same taxon; or 2) The population is delimited "by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist." The Arizona population meets the second criteria by being delimited by the international frontier at the U.S.-Mexico boundary and the issue of discreteness will not be further discussed in this review.

Significance. The test for biological significance requires meeting one or more of four nonexclusive criteria including: 1) evidence that the DPS persists in an ecological setting unusual or unique for the taxon; 2) evidence that loss of the DPS would result in a significant gap in the range of a taxon; 3) evidence that the DPS represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic

range; and 4) evidence that the DPS differs markedly from other populations of the species in its genetic characteristics.

The Taxon

The "taxon" of which the Arizona CFPO is a member and the biological entity to which the Service refers as the "whole taxon" is the subspecies *G. b. cactorum* (cactus ferruginous pygmyowl). *G. b. cactorum* is one of four subspecies of the species *Glaucidium brasilianum* (ferruginous pygmy-owl) that range from the southern United States throughout Mexico and into Central America. Several other subspecies are found in South America, as far south as the Tierra del Fuego (Grossman and Hamlet 1964, Burton 1984, Johnsgard 1988, Cartron and Finch 2000). This largely tropical and subtropical species is considered abundant or extremely abundant throughout most of its range. Not surprisingly, at the northernmost extremes of its range in Texas and Arizona, where most lowland habitats are typically cooler and drier than tropical and subtropical habitats, the species is far less common (deShaunensee 1970, Proudfoot and Johnson 2000, Johnson et al. 2003).

G. b. cactorum historically ranged from central Arizona south through western Mexico, to the states of Colima and Michoacan (the western population), and from southern Texas south through the Mexican states of Tamaulipas and Nuevo Leon (the eastern population). These two populations are separated at the northern end of their range by over 800 km of mountain ranges and Chihuahuan Desert basins in southeastern Arizona, southern New Mexico, and West Texas. The two populations are considered reproductively isolated throughout the United States and northern Mexico (USFWS 1997, Proudfoot and Slack 2001). Similar geographic isolation may not occur at the southern end of this subspecies' range, where the eastern and western ranges of G. b. cactorum are likely contiguous (see Johnsgard 1988 and Burton 1984 for opposing views).

At the time of the Final Rule listing the subspecies under the ESA, the Service believed that no genetic differences existed between the eastern and western CFPO (USFWS 1997). Since the listing, discovery of patterns of mtDNA variation provides strong evidence that there are actually two genetically distinct units, one in Arizona, Sonora, and Sinaloa and the other in Texas and Tamaulipas, south to central Mexico (Proudfoot and Slack 2001). Notwithstanding the new evidence for genetic separation between these two populations and uncertainties of geographic isolation at the southern end of the subspecies' range, for purposes of this discussion (consistent with the listing Final Rule) the eastern and western populations of CFPO in the United States and Mexico are treated as members of the same taxon. This treatment is also consistent with current ornithological convention (American Ornithologists' Union 1957, Oberholser 1974, Phillips et al. 1964, Johnsgard 1988).

THE WHITE PAPER

In their white paper, the Service argues that DPS significance Criterion 1 (evidence that the DPS persists in an ecological setting unusual or unique for the taxon) and Criterion 2 (evidence that

loss of the DPS would result in a significant gap in the range of a taxon) are sufficiently met, thus allowing the DPS determination.⁴

We believe the white paper has failed to make the case for significance under either Criterion 1 or Criterion 2. Deficiencies in the white paper include, but are not limited to, overstating the uniqueness of the Arizona population's association with Sonoran Desert habitat; overstating the potential for losing suitable Sonoran Desert habitats in Mexico; and overstating the impact that loss of the Arizona population would have on the taxon as a whole, both in terms of geographic range and genetic diversity. We address each of these issues below.

CRITERION 1. EVIDENCE THAT THE ARIZONA POPULATION PERSISTS IN AN ECOLOGICAL SETTING UNUSUAL OR UNIQUE FOR THE TAXON

Before addressing the Service's argument for the applicability of Criterion 1, we want to point out their lack of precision in describing the very ecological setting they are trying to make a case for: the Sonoran Desert Biome (SDB). The Service does not define what they mean by the term nor do they provide a reference that would define it. We do not know what its boundaries are, how large it is, or what biotic communities are included in it. In addition to "Sonoran Desert Biome" the Service refers to "Sonoran Desert," "Sonoran Desert scrub," "desert biotic communities," and "desert," although it is not always clear whether these terms are meant to be synonymous. It is not clear whether, in their usage, "Sonoran Desert Biome" includes the arid grasslands that grow within and adjacent to what is commonly called the "Sonoran Desert." This is important because some of Arizona's very few CFPOs, and many pygmy-owls in northern Sonora, occur in what Brown (1994) defines as Semidesert Grassland, not Sonoran Desertscrub. It is impossible to know if the Service is including these owls in their consideration of CFPOs and CFPO range within the SDB. The Service also does not explain that CFPOs are known to occupy only some habitats within what Brown (1994) defines as Sonoran Desertscrub, a biotic community often, but not always, used interchangeably with the term "Sonoran Desert." Large tracts of Sonoran Desertscrub, in fact most of its subdivisions, are not occupied by CFPOs.

To make our rebuttal clear, we are assuming "Sonoran Desert Biome" to equate to Brown's (1994) "Sonoran Desertscrub." This biotic community covers over 70,000,000 acres in four states, Arizona and California in the United States, and Sonora and Baja California in Mexico, although the CFPO occurs only in Arizona and Sonora. Table 1 shows the total acreage of Sonoran Desertscrub habitat in those two states.

Table 1. The area of the Sonoran Desertscrub in Arizona and Sonora.

State	Square Mi	Square Km	Acres	% of Total	
Arizona, USA	34,774	90,063	22,255,108	54%	
Sonora, Mexico	29,315	75,926	18,761,664	46%	
TOTAL	64,089	165,989	41,016,772	100%	

Source: Digitized from Brown and Lowe 1994.

⁴ The Service does not argue that either Criterion 3 or Criterion 4 is met, addressing genetic issues only within the context of Criterion 2.

In the white paper, the Service presents the argument that the Arizona population of CFPOs meets Criterion 1 of the DPS significance policy by persisting in an unusual or unique ecological setting, the Sonoran Desert Biome. The Service summarizes their argument with the dire prediction that:

In the not-so-distant future, the Arizona DPS may represent the majority of pygmy-owls occupying the Sonoran Desert biome, which is a unique ecological setting for pygmy-owls (USFWS 2003a:3).

The Service begins its case by stating the Sonoran Desert Biome is an unusual or unique ecological setting for the CFPO because *only* 25% of its historical range, as the Service defines it, is in desert habitat. This is half of the historical range of the western population (again, as defined by the Service) and includes millions of acres of Sonoran Desert in Mexico where CFPOs are known to be common to abundant (Flesch and Steidl In Press, Cartron and Finch 2000).

At the time of the listing Final Rule in 1997, the Service assumed that CFPOs were not present in northern Sonora. Since that time, however, hundreds of nesting locations have been found in northern Sonora, some are within a kilometer of the Arizona border (Flesch and Steidl 2000, 2002, In Press; see Figure 1). The most recent and best available scientific information on Mexican CFPOs in the Sonoran Desert, developed with the benefit of Service funding (Flesch and Steidl 2000), concludes the following:

In northern Sonora, Mexico, immediately south of Arizona, pygmy-owls are locally common in desertscrub and grassland vegetation communities where woodlands occur near stands of saguaro cacti (Flesch 2003a). Because pygmy-owls in northern Sonora are thought to be abundant, these populations will likely prove critical for recovery efforts in Arizona as well as for long-term persistence of pygmy owls in the Sonoran Desert (Flesch and Steidl, In Press).

The study by Flesch and Steidl (In Press), specific to the Mexican portion of the Sonoran Desert, covered the 5-year period 2000 to 2004. During that period, the researchers documented population declines, but they have not been able to determine whether the decline is within the range of natural variability or a long-term systematic decline associated with human activities. The most recent field data, however, may indicate that the 5-year decrease in individual birds is not a long-term trend.⁵

It is well known that bird populations can fluctuate from year-to-year on the basis of climatic change, resource abundance, habitat modifications, and other factors (Holmes et al. 1986, Blake et al. 1992, Sillet et al. 2000, as cited in Flesch and Steidl In Press). During the time Flesch and Steidl (In Press) were investigating the population trends in the Mexican CFPOs, precipitation

⁵ While this manuscript was in preparation, it came to our attention that the 2005 survey data for Mexico's CFPOs did not reflect a continuing decline in numbers (Pers. Comm. Aaron Flesch to Michael Cross, Michael Cross to SWC, June 22, 2005).

had been declining for several years in the Sonoran Desert (Western Regional Climate Center, 2004). While habitat conversion may have contributed to some of the population decline in 5 years, Flesch and Steidl (In Press) concluded that the causative factors for the fluctuation would remain unknown pending further study. The fact remains that at the present time and for the foreseeable future, the CFPO is a common bird in Sonoran Desert habitats in Mexico.

Given that there are over 18 million acres of Sonoran Desertscrub in Sonora and given the abundance of pygmy-owls and their widespread distribution, we would argue that the Sonoran Desert is hardly an unusual ecological setting for CFPO. The majority of CFPO do not inhabit desert habitats, true, but a sizable minority do.

Apparently the Service also realized their argument was weak and in need of buttressing, because the "new information" provided in the white paper, which they assert was not available at the time of the listing (1997), 6 recognizes the existence of the Mexican portion of the Sonoran Desert. This is a departure for the Service's approach to DPS status for the Arizona population. The Service is now willing to acknowledge that large tracts of CFPO-occupied Sonoran Desert do exist in Mexico, at least for the present. However, the Service's belief now is that DPS status is still valid for the Arizona population because these CFPO-occupied tracts of desert will disappear at some unknown point in the future.

The "new information" in the white paper concerns the ongoing conversion of native vegetation communities in Sonora, Mexico, to buffelgrass (*Pennisetum ciliaris*). This conversion is primarily in the form intentional plantations for grazing livestock. The Service cites a 1988 reference claiming that up to 33% of the State of Sonora (presumably 13 million acres) has been "targeted" for conversion to pasture, and that, according to a 2002 reference, 10% of the state, or approximately 4 million acres, has already been converted. According to the white paper, this conversion, in combination with loss of native habitat to agricultural fields and urban areas, will result in "an unusual ecological setting for the Arizona DPS when contrasted with Mexico" (USFWS 2003a:3). The Service's assumption is that Sonoran Desert habitat occupied today by CFPOs in Sonora will be largely lost, but the Sonoran Desert habitat in Arizona, which is largely unoccupied, will persist because of protections afforded by federal and tribal (Tohono O'odham) land management.

This justification for Arizona DPS status is problematic on at least two grounds. First, a catastrophic loss of Sonoran Desert habitat in Mexico is hypothetical. It may or may not occur. For the present and for the undetermined future, the Sonoran Desert habitat occupied by Arizona CFPO remains neither unique nor unusual for the taxon; therefore, the Arizona population of CFPO does not *currently* meet the test for significance under Criterion 1.

Second, let us assume the Service is correct, and 4 million acres of "desert vegetation" in Sonora have been converted to buffelgrass. The Service does not make it clear whether these 4 million acres are in CFPO habitat or not. As can be seen in Figure 1, in northern Sonora, CFPOs are

⁶ The Final Rule, in the discussion on western Mexico, does in fact discuss this issue: "Extensive conversion of desert scrub and thornscrub to the exotic, buffelgrass, for livestock forage, is now taking place, but quantification is not currently available" (USFWS 1997:10741).

strongly associated with the Arizona Upland Subdivision of Sonoran Desertscrub, but rarely occur in the Lower Colorado River Subdivision. The Service also does not provide any information about the location of the converted acres. If they are in the central Sonora "separation" area, the Service has already excluded them from its "Sonoran Desert Biome." This lack of precision also applies to the additional "targeted" 9 million acres. The Service provides no information that explicitly places them in CFPO habitat, or even in Sonoran Desertscrub. They merely say that "up to 1/3 of the state" was targeted for conversion in 1988. The State of Sonora encompasses approximately 45 million acres and includes several biotic communities. Loss of unoccupied or unsuitable habitat, even though it is "desert vegetation," would not affect the CFPO and its association with the "Sonoran Desert Biome."

CRITERION 2. EVIDENCE THAT LOSS OF THE DPS WOULD RESULT IN A SIGNIFICANT GAP IN THE RANGE OF A TAXON

In the white paper, the Service argues that the Arizona population of CFPO is significant to the taxon as a whole because its loss would constitute a significant gap in the range of the taxon. The Service points out that, according to case law, such a gap may occur "at the end of the fence"; that is, at the periphery of the species' range. The Service goes on to present the argument that the peripheral gap created by loss of the Arizona population would rise to the level of significance because that loss would represent:

... a major portion of the historical range [of the taxon] from the perspectives of both geography (size of the area and percentage of occupancy within the unique Sonoran Desert biome ecological setting)...and population (a peripheral population's contribution to genetic diversity of the species) (USFWS 2003a:4).

Significance of the Arizona CFPO Geographically

In the National Association of Homebuilders v. Norton case before the 9th Circuit Court, the Service argued unsuccessfully that the gap created by loss of the Arizona population would be significant because the extinction of the Arizona pygmy-owl would significantly reduce the historical range of the taxon. In the white paper, the Service presents "new information" to support this position. According to the "new information," the gap created by the loss of the Arizona population of CFPO would constitute 50–60% of the historical range of the CFPO within the SDB. The Service also states that the SDB constitutes 50% of the historical range of the western population, or 25% of the total historical range of the taxon, and that the Arizona population constitutes 15% of the historical range of the western population (which would equal 7.5% of the historical range of the taxon). The Services uses these percentages as evidence that the historical range presumably lost with the demise of the Arizona population of CFPO amounts to a major geographical portion of the historical range of the taxon, and, therefore, loss of the population would create a significant gap in the range of the taxon.

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Obviously, at least one of these figures must be in error because, if the Arizona DPS equals 50% of the SDB, and the SDB equals 50% of the western population, then the Arizona DPS equals 25% of the western population, not 15%. Similarly, if the Arizona DPS equals 60% of the SDB, it must equal 30% of the western population, not 15%. Perhaps the Service meant the Arizona DPS historical range equals up to 15% of the taxon's historical range.

These percentages appear to rest, in part, on the Service's decision to exclude a portion of the SDB in Mexico (central Sonora) from the historical range of the CFPO because, citing Flesch (2003), this area currently has a low abundance (not an absence) of CFPO. The low abundance, according to the Service, is due to unsuitable habitat, including the destruction of native habitat by development.⁸ This region of central Sonora is considered by the Service to be an ecotonal separation that divides the western population of CFPO into two roughly equal groups. Only the area north of the separation is included in the SDB. The Service gives no indication of how much of Sonora is excluded in this ecotonal separation, and provides no acreage figures for any portion of the historical range of the western population of CFPO, including that portion in Arizona. They simply state that half of the historical range of the western population is north the central Sonoran separation and half is south. While these suppositions are vague, may or may not be justifiable, and make use of questionable arithmetic (see footnote 9), the major problem with the Service's areal analysis is that the Service's definition of the historical range of the CFPO in Arizona is not supported by historical documentation.

The Service's definition of the historical range of the CFPO in Arizona is flawed

In their calculation that the range of the Arizona DPS constitutes 50–60% of the Sonoran Desert, the Service assumes that the historical range of the CFPO in Arizona includes all the SDB in the state, approximately 22 million acres, while historical records indicate that only a very small and specific portion of the Arizona Sonoran Desert was ever suitable habitat for the pygmy-owl (see Appendix A). The Service assumes that historical CFPO habitat use in Arizona resembled current CFPO habitat use in Mexico, where CFPOs are common throughout upland desert as well as in riparian vegetative communities. The situation is different in Arizona, where the historical record provides a large body of evidence that suggests the owl depended overwhelmingly on riparian and xeroriparian habitats of the Sonoran Desert. It should not be surprising that the species' habitat preference would be different at the northernmost extremes of its range, where desert habitats are typically cooler and drier than the tropical and subtropical habitats farther south.

During the late 1800s, when Arizona riparian and desert habitats in central and southern Arizona were still in a relatively pristine condition, several naturalists traveled through the area and left detailed records on wildlife encountered and/or collected (see Johnson et al. 2003, 2004 for a summary of records). As shown in Figure 2, in the northern reaches of CFPO range in Arizona, historical records overwhelmingly associate CFPOs with riparian habitats within the desert biome, primarily along the Gila, Salt, Verde, and Santa Cruz Rivers, and various tributaries, with scattered records in other locales. According to the records, the CFPO's primary habitats were cottonwood-willow (*Populus-Salix*) gallery forests with a mesquite understory (*Prosopis velutina*) in riparian environments and mesquite bosques in xeroriparian environments. In Arizona, pygmy-owls were rarely found in upland Sonoran Desert habitats. Consequently, of the approximately 22 million acres of Sonoran Desertscrub in Arizona, which the Service appears to consider all

⁸ It is ironic that the Service has chosen to exclude central Sonora for these reasons, while including larger areas in Arizona that either 1) have never had records of CFPO, or 2) have no recent records, probably due to habitat modification by development.

within the CFPO historical range,9 we estimate that only a small portion, 200,000 acres, or less than 1%,10 was ever occupied by CFPOs.

The current range is even smaller. Throughout the twentieth century, the CFPO's distribution in Arizona contracted until now this owl is found almost exclusively in extreme southern Arizona, near the border with Mexico (Figure 1). The Service itself attributes this constriction in range to loss of riverbottom forests and bosques, which "have been extensively modified and destroyed by clearing, urbanization, water management, and hydrological changes" (USFWS 1997:10740). Since the CFPO appears to have depended heavily upon riparian and xeroriparian habitats in most of its Arizona range, and the CFPO vanished with the loss of such habitats, it seems highly unlikely that the pygmy-owl would repopulate formerly occupied areas unless or until riparian and xeroriparian habitats were restored. However, given the level of urban and agricultural development in the state, the rate of population growth, and the intense competition for limited water resources, wide-scale restoration of stream flows and riparian and xeroriparian habitats in the Gila River drainage is not a realistic possibility. The CFPO is not likely to expand beyond its current distribution in Arizona. In short, the Service has greatly overstated the extent of historical CFPO range in Arizona and fails to acknowledge that little suitable habitat is or will ever be available for the owl within the state. If the Service were to use a more realistic estimate of the historical CFPO range in Arizona, the acreage and the percentage of the taxon's range in Arizona would be much less than the Service claims. Loss of the Arizona pygmy-owls, in fact, would significantly reduce neither the true historical nor the current range of the taxon.

The Service's misunderstanding of CFPO habitat use in Arizona was fueled by the discovery of nesting CFPOs in the large-lot neighborhoods in the arid upland desert of northwest Tucson in 1996. The discovery of just over a dozen individual breeding CFPOs in this area led some Service and Arizona Game and Fish Department biologists to the erroneous conclusion that arid upland habitats constituted a preferred and suitable habitat for the CFPO in Arizona (Wilcox et al. 1999, USFWS 1997). As a result of this discovery, some of these same biologists concluded that urban development in the arid upland deserts around Tucson was a significant threat to the Arizona population of pygmy-owls (USFWS 1997). Given the strong evidence that this species historically preferred riparian and xeroriparian habitats, not upland desert, in the Tucson area, we propose that the nesting owls in northwest Tucson did not predate urban development; rather they were drawn by it, specifically by the artificial or cultivated riparian habitats associated with residential development (Johnson and Carothers 2003). The data illustrated in Figure 3 strongly support this interpretation. All of the northwest Tucson known CFPO territories were in association with some form of human development (Wilcox et al. 1999). Arid upland areas adjacent to northwest Tucson in relatively pristine and undeveloped desert habitat were not found to contain CFPOs.

⁹ Again, because of the vague use of terms in the white paper and the failure to provide acreages, it is difficult to tell what the Service considers historical range for the CFPO in Arizona, other than it is 50–60% of the SDB..

We calculate that no more than 200,000 acres within Arizona was ever utilized by CFPOs (this number excludes approximately 1 million acres, the southern 1/3 of the Tohono O'odham Nation lands where historic and contemporary information on CFPO distribution is generally lacking but which is now assumed, on the basis of recent information indicating large numbers of CFPO in Mexico immediately to the south, to be suitable for pygmyowls). We based this calculation on measuring the length of each river drainage from which historic CFPO occupation was documented, assuming that the width of each drainage was at least a mile, and adding these areas to the areas currently occupied by CFPO. Thus, less than 1% of the available Sonoran Desert in Arizona has ever been occupied by pygmy-owls.

Today, the northwest Tucson population of CFPOs has for all practical purposes gone functionally extinct. This population has declined in 7 years from 17 breeding birds at 11 sites with 16 young fledged in 1999, to only two males in 2005, and only 2 young produced since 2003, none in 2004, and none expected from the activities of the two males in 2005 (Abbate et al. 1996, 1999, 2000; Johnson and Carothers 2003; Arizona Daily Star 2005; see Figure 4). At the rate the northwest Tucson CFPOs have declined, without some kind of augmentation, "there will be no more pygmy-owls in this urban area within 1 to 2 years. This is in spite of the fact that millions of dollars of conservation money has been poured into attempts to stave off the elimination of this small aggregation of owls (USFWS 2003b). This extirpation was apparently inevitable, and was in fact predicted (Johnson 2002, Johnson and Carothers 2003). Urban areas can act as ecological traps for some species of animals, luring them with abundant food sources, but then exposing them to a multitude of unnatural hazards. CFPOs were likely attracted by an increased prey base and thick, cultivated vegetation that provided cover and nesting and roosting habitat. Unfortunately, they also encountered increased levels of predation, disease, and other anthropogenic hazards that have resulted in high levels of mortality in other urban raptors, especially in the Tucson area (Boal 1997; Boal and Mannan 1998, 1999; Johnson and Carothers 2003; Mannan et al. 2000). The aggressive efforts by agencies to save these birds—first with endangered DPS status, then with intense study, including radiotelemetry, banding of adults and young, as well as other intrusive techniques—were apparently doomed from the beginning.

In summary, the evidence suggests that the appearance of CFPOs in the Tucson area in the 1990s and their subsequent demise does not represent the species' natural habitat preference or its natural life history cycle. The preponderance of that evidence still suggests that CFPOs, at the cooler and drier northern periphery of their range, selected narrowly circumscribed riparian and xeroriparian habitats, and that historical range is far smaller than represented by the Service in their white paper.

Significance of the Arizona CFPO in Terms of Population

Another way that the loss of a DPS would result in a significant gap in the range of a taxon (that is, reduce the current range of the taxon) would be if the discrete population actually makes up a large percentage of the total population of the taxon. This is not the case; in fact, the Arizona CFPOs are an insignificant fraction of the total numbers of pygmy-owls represented by the taxon. At the time of the listing, the Service estimated there were fewer than 40 birds in the State of Arizona (USFWS 1997). Recognizing that the Arizona population is miniscule compared to the rest of the western population, the Service does not attempt in the white paper to argue that their loss would amount to a significant percentage of the taxon as a whole. The Service does, however, present an argument that the gap created by the extinction of the Arizona pygmy-owl would be significant because it would decrease the genetic variability of the taxon.

¹¹ Proudfoot and Slack (2001) have interpreted mtDNA data on northwest Tucson CFPO as indicating that this small, very local population has been separated from pygmy-owls in Mexico for at least 70+/- years. It is possible that the origin of these birds was either southern Arizona or Mexico and that a similar "invasion" could occur again. However, 70 years ago the multi-lane Interstate 10 and extensive agricultural development on the west side of the freeway were not in place. These relatively recent developments may preclude CFPOs from ever naturally reaching northwest Tucson again (see USFWS 2003b for additional discussion on barriers to CFPO movements).

Their argument is not based on genetic studies of the CFPO; in fact, their argument is not based on data at all, but on theory. The Service readily admits in the white paper that there is "...not a marked genetic difference between the Arizona DPS and the rest of the [western population]..." (USFWS 2003a:4). It is not surprising that there would be little genetic difference between the pygmy-owls in Arizona and those in Sonora, given the close proximity of most of the populations and the lack of any physical barrier between them. The Arizona CFPOs are not spatially or genetically disconnected from the core of the population to the south.

The Service base their case for genetic significance on the fact that the Arizona CFPOs are a peripheral population,

... the loss of which could result in the reduction of genetic variability, which in turn would reduce the species ability to adapt to changing environmental conditions and increase the likelihood of extinction (USFWS 2003a:5).

This argument is weak because there is no evidence of significant genetic variability in the western population of pygmy-owls that have been studied (Proudfoot and Slack 2001). They say "genetic divergence tends to occur at the periphery of a species' range," yet there is no evidence of significant genetic divergence in the pygmy-owls studied. They say "peripheral populations may become genetically distinct" because they "are often isolated from core populations," yet there is no evidence of genetic distinction in the pygmy-owls studied, and Arizona's CFPOs are not isolated from the core population in Mexico. They say that "In the face of changing environmental conditions, what constitutes a peripheral population today could be the center of the species' range in the future." Yet given the small number of known CFPOs in Arizona (excluding the population on Tohono O'odham lands, which is of unknown size), their very limited range in suitable habitat along the border with Mexico, and the large numbers of CFPOs in Mexico, it seems extremely unlikely that Arizona's pygmy-owls would every become the center of the species' range in the future. Their argument is entirely hypothetical and hardly supports the contention that loss of the Arizona population would represent a significant gap in the historical and current range of the taxon due to loss of genetic variability.

How Probable is the Loss of the Arizona CFPO Population?

With the demise of the CFPO in northwest Tucson, the status of the Arizona pygmy-owls may appear ominous. However, the remaining known pygmy-owl populations in Arizona, while rare, are apparently not in danger of extinction. These populations, which are found in the extreme southern portion of the state, appear to be stable compared to the Tucson population. For the most part, these CFPOs occur in areas protected and managed by the Service (Buenos Aires National Wildlife Refuge – 118,000 acres in the Altar Valley), the National Park Service (Organ Pipe Cactus National Monument – 330,688 acres), and the Tohono O'odham Nation -3,000,000 acres), and several hundred thousand additional acres of BLM, State Trust Lands and private land in the Altar Valley. With the exception of some of the private land in the Altar Valley,

¹² Arizona Game and Fish Department records for the period 1999–2005 for the Altar Valley are: 1999 (4 CFPOs); 2000 (1); 2001 (7); 2002 (2); 2003 (no data); 2004 (3); 2005 (5). Organ Pipe Cactus National Monument has consistently had 1 to 3 CFPOs since 1999.

threats that could be altered by DPS status are non-existent to minimal, or already under management consideration (e.g., grassland habitat restoration, control of grazing, control of exotic grass invasion) (USFWS 2003a).

Little information is publicly available on the status of CFPOs on Tohono O'odham lands; however, it is reasonable to expect similar densities of CFPO as have been found in comparable habitats immediately south of the border in Sonora (Johnson and Carothers 2003). Service-sponsored studies have demonstrated that pygmy-owls have been found nesting along the border within a few kilometers of Tohono O'odham land (Figure 1) (Flesch and Steidl 2000, 2002, In Press). Knowledgeable ornithologists (including some Service biologists) now propose that there are significantly more CFPOs occupying Tohono O'odham lands than was thought at the time of the listing (Johnson and Carothers 2003).

Given all these factors, combined with the numbers of CFPOs in northern Sonora that could readily repopulate suitable habitat north of the border, there is little reason to believe that a gap will appear at the Arizona "end of the fence" in the CFPO range.

SUMMARY AND CONCLUSIONS

We have reviewed the Service's white paper and found that it does not provide sufficient "new information" or relevant analysis of previously existing information on the CFPO to contradict the 9th Circuit Court of Appeals ruling that the Service was arbitrary and capricious in its DPS determination, specifically the court's conclusion that the Arizona population is not "significant" to the taxon as a whole. Our analysis of the known biology of the CFPO and the conditions required by the Service's DPS Policy (61 FR 4722) for meeting the "significance" criteria lead us to conclude that the 9th Circuit reached a biologically correct conclusion.

The white paper has failed to make the case for significance under either Criterion 1 or Criterion 2 of the Service's policy for recognition of distinct vertebrate population segments under the authority of the ESA. Deficiencies in the white paper include, but are not limited to, overstating the uniqueness of the Arizona CFPO population's association with Sonoran Desert habitat; overstating the potential for losing suitable CFPO Sonoran Desert habitats in Mexico; and overstating the impact that loss of the Arizona CFPO population would have on the taxon as a whole, both in terms of geographic range and genetic diversity. Fundamental to the Service's argument for DPS significance is an erroneous understanding of the CFPOs habitat use and historical range in Arizona. They assume Arizona CFPOs utilized large areas of upland Sonoran Desert habitat, though they admit few historical records support this view. We give more credence to the historical records, which indicate a strong preference by pygmy-owls for riparian and xeroriparian habitats in Arizona, which is at the northern periphery of their range and cooler and drier than the tropical habitats to the south.

In keeping with our understanding of CFPO habitat use, we provide an alternative biological interpretation from that held by the Service for the rise in the early 1990s and imminent demise (perhaps as soon as 2006) of the northwest Tucson population of CFPOs. The Service maintains that the CFPO's appearance in northwest Tucson reflects the species' natural habitat preference for arid upland Sonoran Desert habitats. Contrary to this interpretation, and based on historical

and recent evidence, we maintain that the Tucson owls were attracted to the artificial riparian habitat in the large-lot development because cultivated landscaping simulated the Arizona pygmy-owl's natural and historical habitat of riparian and xeroriparian vegetative communities. The CFPO is known to occur around the edges of villages and agricultural areas in the tropics, but its willingness to use artificial or cultivated riparian habitat in the United States has not been acknowledged until now. Unfortunately, these urban areas serve as ecological traps for CFPOs, luring them with an increased prey base and dense vegetation, but presenting hazards (e.g., increased traffic and numbers of predators) that contribute to high levels of mortality. Compared to the northwest Tucson pygmy-owls, CFPOs in the southern extreme of Arizona (Altar Valley, Organ Pipe Cactus National Monument, and very likely Tohono O'odham Nation lands) seem to be relatively stable in numbers and distribution. They primarily occur in natural habitats on land under federal, state, or tribal management where they are protected from threats that would justify DPS status.

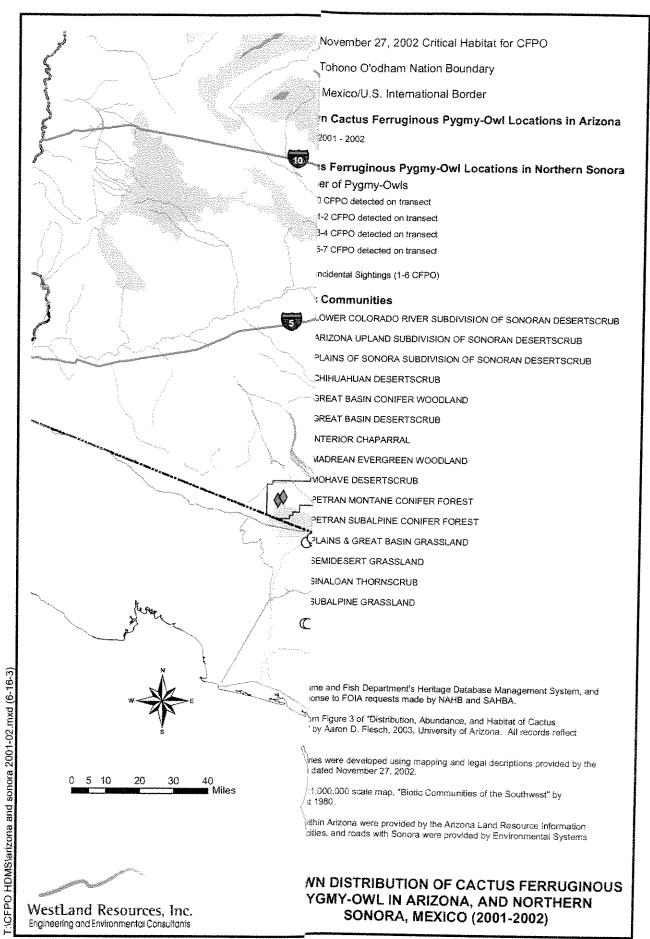


Figure 1. Known distribution of cactus ferrugin/led in the northwest Tucson area.

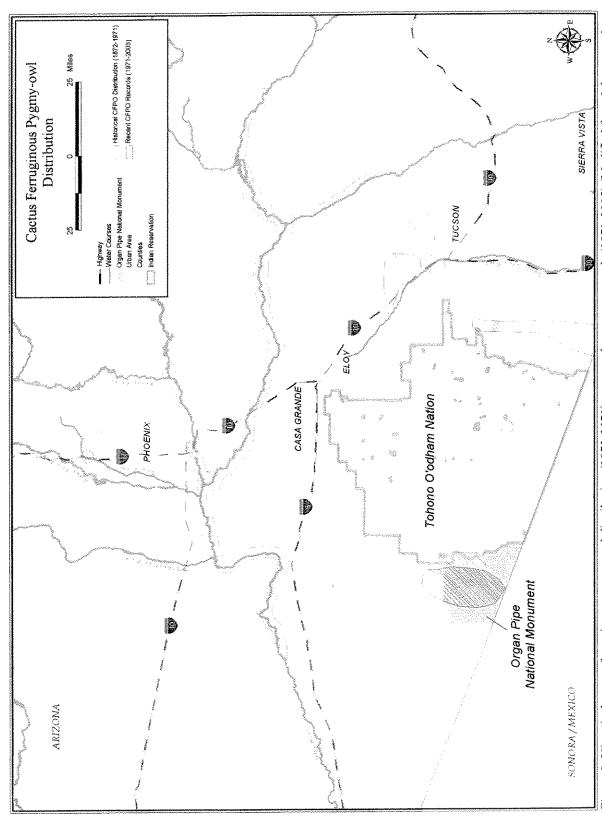


Figure 2. Historical cactus ferruginous pygmy-owl distribution (1872-1971) compared to recent records (1971-2005) (Modified from Johnson and Carothers 2003).

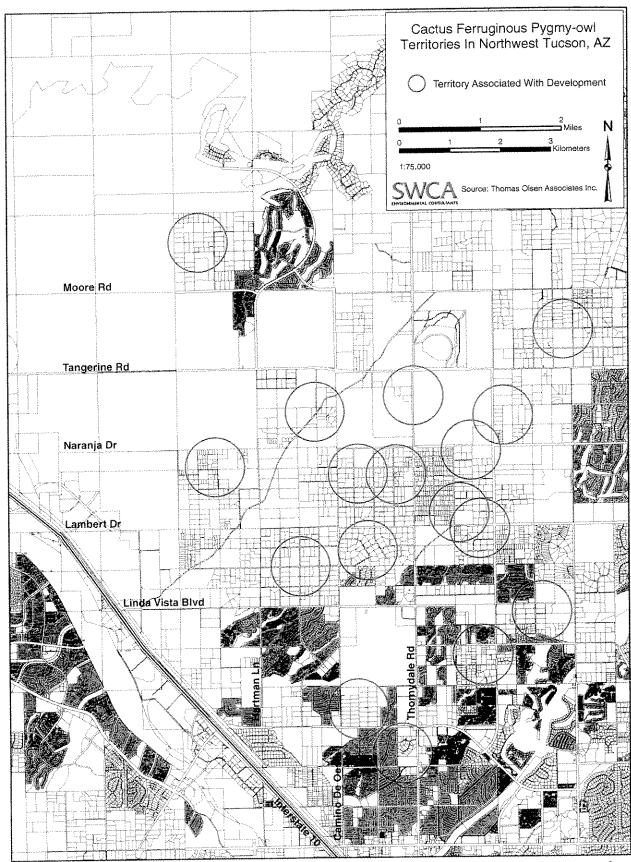


Figure 3. Cactus ferruginous pygmy-owl territories in association with urban development and artificial or cultivated riparian habitat in northwest Tucson, 1999-2003 (modified from Johnson and Carothers 2003).

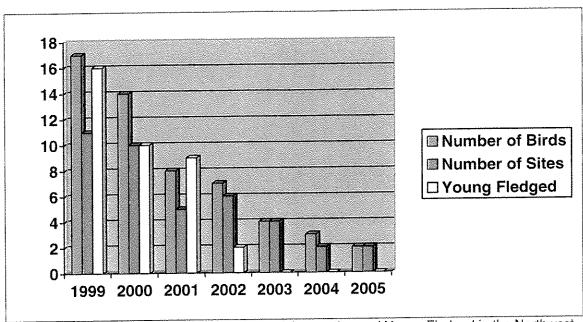


Figure 4. Number of CFPO Individuals, Sites of Occupation and Young Fledged in the Northwest Tucson, Arizona Aggregation from 1999 to 2005 (Modified from Johnson and Carothers 2003).

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APPENDIX A

Suitability and Utilization of Sonoran Desert Habitats by CFPOs in Arizona and Sonora

The white paper on the Significance of the Western Population(s) of the Cactus Ferruginous Pygmy-Owl developed by the U.S. Fish and Wildlife Service (Service) argues that the millions of acres of Sonoran Desert Biome in Arizona constitute unusual and unique cactus ferruginous pygmy-owl (CFPO) habitat (USFWS 2003a). The white paper also argues that loss of the Arizona population of CFPOs would create a significant gap in the range of the taxon because the historical range of the Arizona owls equates to 50–60% of the Sonoran Desert Biome within the species' range. This is an exaggeration of the portion of Arizona Sonoran Desert actually used by or suitable for the CFPO. The evidence documenting that only a very small and specific portion of the Arizona Sonoran Desert is or was suitable for the pygmy-owl is presented below.

The historical as well as current evidence for habitat selection by breeding CFPOs in Arizona and Mexico clearly indicates that as the birds move farther north from Mexico they are primarily associated with both wet riparian and xeroriparian habitats. CFPOs have rarely been found in primarily arid upland Sonoran Desert habitats in Arizona (Johnson et al. 2002, 2003, Johnson and Carothers 2003). During the late 1800s, when riparian and desert habitats in central and southern Arizona were still in a relatively pristine condition, several naturalists traveled through the area and left detailed records on wildlife encountered and/or collected (see Johnson et al. 2003, 2004 for a summary of records). In our opinion, these records and collections provide an accurate historical account of wildlife occurrences and habitat preferences for most desert and riparian species, including the CFPO.

The historical record provides a large body of evidence that suggests the owl was never common in Arizona and that it was almost exclusively dependent on the more mesic habitats of the Sonoran Desert. In fact, the pygmy-owl's attraction to wet riparian and artificial or cultivated riparian habitats was first noted in the Phoenix region in the late 1800s by G.F. Breninger:

...since trees planted by man have become large enough to afford nesting sites for woodpeckers, this Owl has gradually worked its way from the natural growth of timber bordering the rivers to that bordering the banks of irrigating canals, until now it can be found in places ten miles from the river" (Breninger 1898:128).

The collection of 39 owls and 11 sets of eggs in the entire state of Arizona from 1872 to 1953 (50 specimens in 81 years, see Table A-1) hardly suggests a common bird (Johnson et al. 2003). This is especially true when one considers that during this period ornithologists, oologists and other naturalists collected thousands of avian specimens in southern Arizona. C.E. Bendire, one of the most notable and prolific of the late 1800s ornithologists, called the CFPO "not common" in Arizona (Bendire n.d., see also Bendire 1888). On one of Frank Stephens several collecting trips to the Tucson region, from early March through June, 1881, he collected hundreds of birds including 29 Lucy's warblers (*Vermivora luciae*) and 13 each of the brown-crested flycatcher (*Myiarchus tyrannus*), Crissal thrasher (*Toxostoma crissale*), and Bendire's thrasher (*T*.

bendirei). All 13 of the brown-crested flycatchers and 5 of each of the two thrashers were collected at Ft. Lowell, yet, he found and collected only a single CFPO during the entire 4-month period (Brewster 1882, 1883). This seems odd, unless the pygmy-owl was rare, since CFPOs are active at all times of the day, thus are easily seen in areas where they are common. In addition, they may call at any time of the year and are generally easily observed as they call. Pygmy-owls are also often mobbed by small birds, causing a commotion that often draws attention to an owl sitting a tree in broad daylight. Thus, the lack of records suggests that the species was generally uncommon, but perhaps locally common at specific sites, especially along Rillito Creek and the Salt and Gila Rivers (Johnson et al. 2003).

Table A-1. Distribution of cactus ferruginous pygmy-owl specimens taken in Arizona by 20-year intervals during the first 100 years after its discovery. No know specimens have been taken in the state since 1953.

Years	Phoenix Area		Tucson Area		Gila River Area		TOTAL	
• • • • •	Birds	Egg Sets	Birds	Egg Sets	Birds	Egg Sets	Birds	Egg Sets
1872–1891	6	0	0	0	1	0	7	0
1892-1911	1	0	13	9	3*	2	17	11
1912–1931	9	0	0	0	0	0	9	0
19321951	2	0	3**	0	0	0	5	0
1952-1971	1	0	0	0	0	0	1	0
TOTALS	19	0	16	9	4	2	39	11

(after Johnson et al. 2003, 2004)

On the basis of the historical record and recently published and unpublished information available to us, it is apparent that CFPOs were never a very common species throughout central Arizona and the Tucson area except in small clusters or local concentrations of breeding birds within or adjacent to the wet riparian habitats of the Salt and Gila Rivers and Rillito Creek. The historical record and our current understanding of the CFPO distribution in Arizona indicates that north of Organ Pipe Cactus National Monument, north of the southern one-third of the Tohono O'odham Nation and north of the Altar Valley, arid upland desert habitats were and are only rarely used, and for the most part, only then when those habitats were in association with large desert washes and/or human developments. Contrary to the opinions advanced in the Service white paper (USFWS 2003a) and the Final Rule for listing (USFWS 1997), except in the extreme southern portions of Arizona, upland Sonoran Desert habitats were and are largely unsuitable and as unused by pygmy-owls in historical times as they are now.

However, throughout Mexico's Sonoran Desert and the extreme southern portions of Arizona, CFPO habitat selection changes (Johnson and Carothers 2003). In Mexico and the extreme southern portions of Arizona, the CFPO is found more frequently in upland habitats in Sonoran Desertscrub and Sonoran Semidesert Grassland. However, the species' primary preferred habitat

Includes one live bird taken at Agua Caliente and released later (Gilman 1909).

^{**} Includes a specimen taken by Moore on Indian lands at Fresnal, in the Baboquivari Mountains.

remains in dense wooded thickets or woodlands where large trees or columnar cacti are also available (Johnson and Carothers 2003).

At the extreme northern edge of the CFPO's range, climatic conditions and other factors combine to limit the owls to wet riparian areas. We believe insufficient attention has been placed on climatic factors in determining areas essential for the survival of the CFPO. The Proposed Rule for CFPO critical habitat (67 FR 71031) described CFPO habitat requirements and primary constituent elements almost exclusively on vegetation parameters, and the Service white paper (2003a) continues to espouse the erroneous theory that all upland Sonoran Desert habitats meet the CFPO needs. Other factors that commonly determine types of plants and animals inhabiting a given area have been scarcely discussed. Thus, there has been little analysis of potentially critical factors such as mean average temperatures, wind directions and intensity, precipitation, flood-prone zones, pan and lake evaporation rates, topographic parameters, and frost-free zone gradients.

Since pygmy-owls are basically a tropical species, factors that determine levels of ambient moisture are likely critical habitat elements. An examination of climatic factors from maps, including thermoclines, wind patterns, and other information, reveals some interesting factors overlooked by the Service (see USDA 1977). Our analysis suggests the owl's distributional pattern in Arizona correlates with climatic factors relating to number of frost-free days and mean average January and July temperatures. The owls seem to prefer areas that remain frost-free for a minimum of 270 days and have mean average temperatures of 50 degrees and 86-88 degrees in January and July, respectively (USDA 1977, Johnson and Carothers 2003, Pers. Comm. Glynn Burkhardt to RRJ, January 2003). More analysis is required to better understand influence of climate on CFPO distribution, but the data suggest that pygmy-owls do not tolerate extreme freezing. This may explain the difference between the species' historical preference at the northern edge of its range for wet riparian areas, and its occupation in more southerly regions of xeroriparian and upland habitats. Pygmy-owls may have been able to tolerate the colder winter conditions of the higher latitudes by utilizing wet riparian habitats where the occasionally freezing temperatures of the surrounding upland areas are moderated by the riparian vegetation and water.

Climate may also be a critical factor in explaining the apparent differences between habitat preferences of this species (riparian vs. upland) in the northern and southern parts of its range; however, care must be taken not to over emphasize those differences. The most recent analysis of the species in northern Sonora, Mexico, found that "although the vast majority of nest saguaros were located in uplands, they were clearly associated with drainages and nearby riparian vegetation" (Flesch and Steidl 2002:9). It appears that almost everywhere the Arizona CFPO is found—either currently or historically—riparian habitat, be it wet riparian, xeroriparian, or artificial or cultivated riparian, plays an important role in satisfying essential life history requirements of the species.

It has been suggested that early baseline ornithological investigations were insufficient in frequency and scope to compare the distribution and status of the CFPO in Arizona today with what was found in the past (USFWS 2003b). At the time of the listing the presence of the now diminished population of CFPOs in the upland desert of northwest Tucson area led many

biologists to hypothesize that other desert areas in the state may be occupied. This hypothesis, in part, inaccurately assumed that the early ornithologists and naturalists spent most of their time within the state's river valleys and simply overlooked upland desert populations of CFPO (USFWS 1997).

In 2000, the Service released survey protocols¹³ for surveying land prior to development for potential occupation by CFPOs. To ensure against potential Endangered Species Act Section 9 violations, the Service required field surveys for CFPO detection prior to any state, federal, or private land disturbance. As a result of these surveys, a very large body of evidence exists documenting the absence of CFPOs in hundreds of thousands of acres of arid upland Arizona Sonoran Desert habitat. Sufficient field surveys have been performed since 1997 to demonstrate that CFPOs do not generally use arid upland desert habitats,¹⁴ and that the northwest Tucson pygmy-owl demise was first and foremost an example of CFPO habitat selection for riparian habitat (albeit artificial or cultivated riparian habitat), and secondly an example of the incompatibility of CFPOs in urbanized habitats. The evidence is very strong that CFPOs were not present in northwest Tucson until it was subjected to large lot development (1 house per 3–5 acres), that the pygmy-owls were attracted to the artificial or cultivated riparian habitat, and that they could not survive the increased mortality linked to anthropogenic activities associated with this habitat type.

One of the central themes in the CFPO listing Final Rule (USFWS 1997), that housing developments in northwest Tucson posed a threat to pygmy-owls, in retrospect, was an ironic but post ad hoc conclusion. The housing developments were and are not a good place for CFPO nesting attempts, but pygmy-owls would not have been attracted to those desert areas in the first place without the artificial or cultivated riparian habitat associated with the developments (see Figure 3 in the body of the paper). If this were not the case, CFPOs would have been found by now in other relatively "pristine" desert areas in northwest Tucson, as well as in hundreds of thousands of acres of other arid upland areas in Pima, Pinal, and Maricopa Counties where development has yet to occur.

We have previously brought our interpretation of these data (historic information and current distribution of CFPOs) to the attention of the Service and others (Johnson 2002, Johnson and Carothers 2003), and with two exceptions, have yet to receive any scientific peer or Service review of our documents. The first exception is from Dr. William Mannan, writing a response apparently for the majority of the CFPO Recovery Team; he stated, "...we agree with Dr. Johnson that the group of owls in northwest Tucson is not likely to expand into unoccupied habitat without assistance" (Mannan, In Litt., 2002). The second exception was a review of Johnson's "minority report" (2002) by two Arizona State University professors of biology who called Johnson's Minority Report a "sound and scientifically rigorous analysis" when asked to

¹³ Arizona Game and Fish Department and U.S. Fish and Wildlife Service. 2000. Cactus ferruginous pygmy-owl survey protocol.

We know of two recent records (but have not visited the sites ourselves) of CFPOs that may be in arid upland habitats not associated with large washes or cultivated riparian habitats: one area in the Santa Rosa Mountains northwest of Tucson where three owls have been documented in the past three years, and another single bird reported from the Roskrug Mountains south of Tucson.

review the report by staff of the Center for Biological Diversity, Tucson (Pearson 2002, Brown 2002). Now that the northwest Tucson population of CFPOs is functionally extinct, as we predicted it would be (Johnson 2000, Johnson and Carothers 2003), our evaluation of the species habitat needs in Arizona reveals the only cogent explanation for why the northwest Tucson CFPOs disappeared so rapidly. Our interpretation of the data is that the northwest Tucson birds are an example of a relatively recent invasion of CFPOs from southern Arizona or Mexico that were attracted to artificial or cultivated riparian habitat in the neighborhoods of northwest Tucson. There they initially they gained a foothold, but eventually succumbed to high levels of predation, disease and/or inbreeding¹⁵ (Johnson and Carothers 2003).

It is not uncommon for species of Mexican origin to periodically invade southern Arizona (Phillips et al. 1964, Phillips 1968). Pygmy-owl border crossings are known to occur, and longdistance flights are apparently not uncommon. Recent radiotelemetry data from the Arizona Game and Fish Department CFPO monitoring program in the Altar Valley have documented flights in excess of 100 miles (Pers. Comm. Michael Ingraldi to Michael Cross, June 21, 2005). In addition, when many lowland Mexican bird species cross into Arizona, they often show a decided preference for riparian habitat. For example, many species of Mexican birds whose ranges extend a short distance into the southern U.S. are obligate or preferential wet riparian nesting species in Arizona, but occupy a broader array of habitat types in Mexico (Howell and Webb 1995, American Ornithologists' Union 1998). These species include the gray hawk (Asturnia nitida) (Bibles et al. 2002), thick-billed kingbird (T. crassirostris) (Lowther 2002, American Ornithologists' Union 1998), and tropical kingbird (Tyrannus melancholicus) (Stouffer and Chesser 1998), to mention a few. The CFPO is among approximately 35 species of mostly Mexican birds that occur in southern Arizona. Additionally, many of these Mexican species have known U.S. populations of fewer than 100 individuals, sometimes fewer than 10 or 20 known pairs, e.g., the buff-collared nightjar (Caprimulgus Ridgwayi) (Bowers and Dunning 1997), buff-breasted flycatcher (Empidonax fulvifrons) (Bowers and Dunning 1994), and fivestriped sparrow (Aimophila quinquestriata) (Groschupf 1992). These species, the ranges of which barely enter Arizona, are, like the CFPO, common-to-abundant in Mexico, and have appropriately not been considered for DPS status. The situation with the CFPO is not substantially different from these Arizona rare, but Mexico common, species.

LITERATURE CITED (See References Cited section in body of paper)

¹⁵ As a result of the extremely low numbers of owls in the northwest Tucson aggregation, some individuals were inbred, with five examples of incest (brother/sister, father/daughter, mother/son pairings and breeding) (Pers. Comm. Michael Ingraldi to SWC, January 2003; Arizona Game and Fish Department unpublished data).